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MACHINERY

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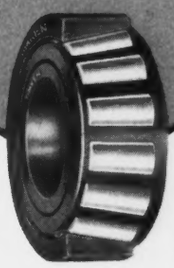

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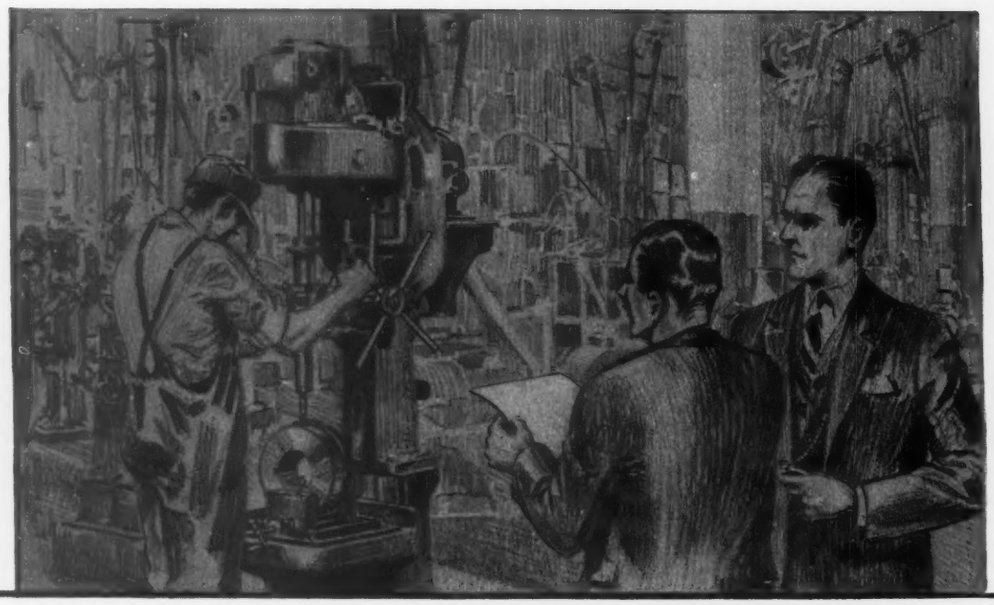

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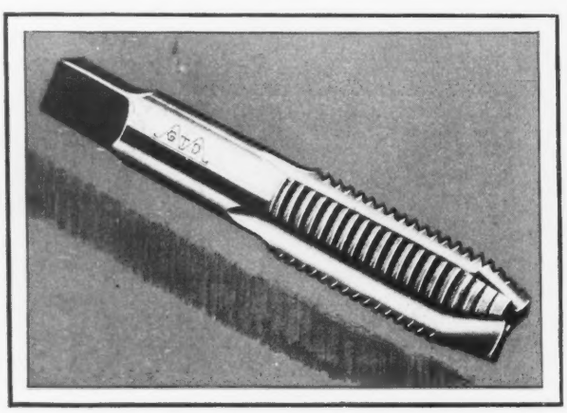

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MACHINERY

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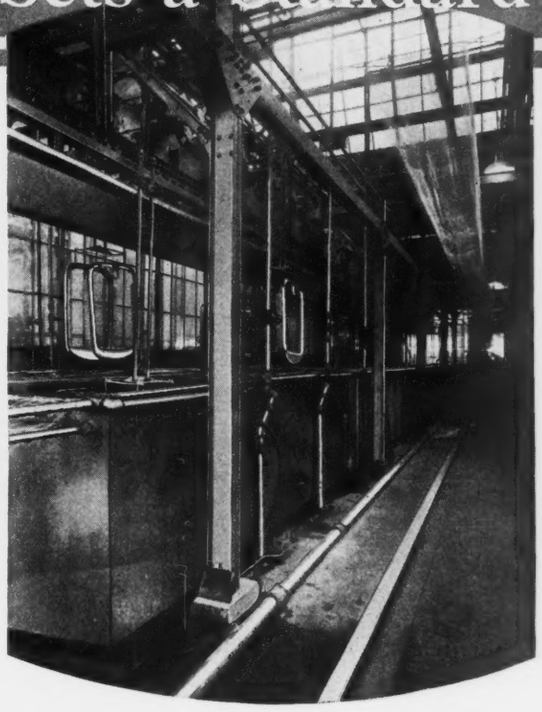
Plymouth Plating Department Sets a Standard



A Model Installation for Electroplating Radiator Shells and Other Parts in an Automobile Plant

By CHARLES O. HERB

ECONOMICAL production must necessarily be the first aim in planning new methods of manufacture, but in striving for this objective, executives should give serious consideration to the selection of equipment that will safeguard the health of employes. Careful thought was given to this vital point in planning the plating department for the new Plymouth plant of the Chrysler Corporation, Detroit, Mich. As a result, conveyors eliminate manual handling of parts as far as possible; exhaust systems withdraw fumes from the plating tanks and all dust from the buffing machines on which the radiator shells and other parts are buffed prior to and between the plating operations; and the construction of the building is such as to permit daytime operation of the department with natural light.

The plating department proper is completely isolated from the remainder of the shop by glass partitions to prevent dust from the machining operations settling on parts being plated or on the solutions in the different tanks. Escape of fumes to other sections of the shop is also prevented and ventilation of the plating department is facilitated. The plating department is laid out so that 1000 radiator shells can be handled per nine-hour day.

Conveyors Carry Buffed Shells Direct to the Plating Department

The majority of the work in the plating department consists of steel radiator shell stampings. These shells arrive at the plant in freight cars and are trucked from the unloading platform direct to the buffing department shown in Fig. 1, a distance of only about 40 feet. Here each rough shell is thoroughly buffed by four men who work on different sections of the part. When finished, the shells are hung on hooks of the overhead conveyor, as illustrated, which is done without the men stepping away from their machines.

There are thirty-two Gardner buffing machines in the department, so arranged that two men can conveniently work at the opposite ends of each machine. The shells are buffed not only upon their receipt at the plant, but also after the copper-plating and nickel-plating operations, as will be explained. From Fig. 1 it will be seen that exhaust ducts connected to both ends of each machine withdraw all dust from the buffing operations into an overhead exhaust system.

Many Baths Insure Thorough Cleaning Before Plating

As satisfactory electroplating of metal parts depends to a large extent upon first thoroughly cleansing the parts from all dirt, grease, etc., the equipment in the Plymouth plant was designed to insure absolutely clean work. The conveyor on which the buffed shells are hung carries them into the glass-enclosed plating department and immediately into a "Kleen-E-Z" washing machine. While the radiator shells pass through the first section of this machine, they are sprayed with hot soda water from all directions in a multitude of streams. In the second section, the shells are rinsed with warm water in a similar manner. Hot water is not used for rinsing, as it would tend to dry the shells and stain them. Four minutes elapse from the time the shells enter the machine until they pass out at the opposite end.

When the shells leave the washing machine, as shown in Fig. 2, an attendant removes them from the first conveyor and, without stepping from his position, hangs them on a second conveyor that passes over a line of washing and copper-plating tanks of approximately twice the length seen in the

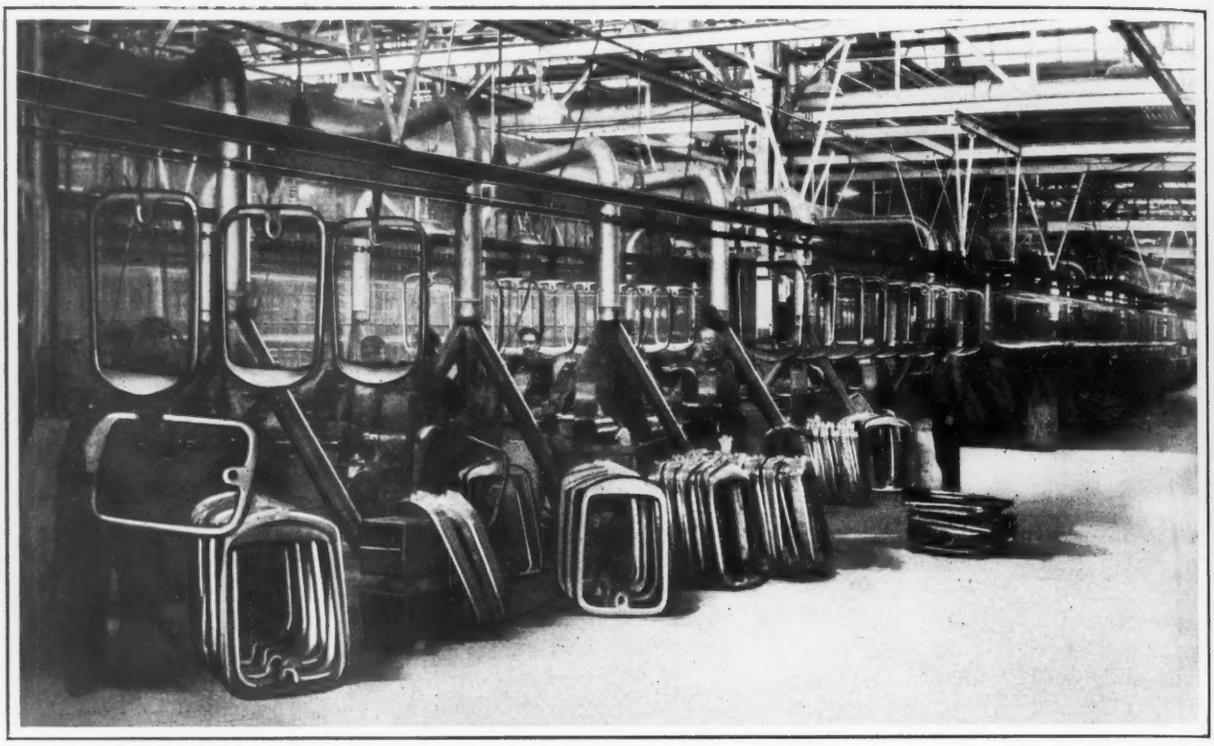


Fig. 1. Buffing Department Having Thirty-two Double-spindle Machines, where the Radiator Shells are Buffed prior to and between the Various Plating Operations

heading illustration. Each radiator shell is suspended from this conveyor on two copper bars about 4 feet long.

Arranged above the various tanks are series of slowly rotating arms which automatically lift the bars on which the shells are suspended, move them horizontally, and lower them again, so as to immerse the shells into the solutions without any manual handling. The shells are dipped into eight different washing and rinsing tanks of the copper-plating group before reaching the plating tank, and are also given a final rinsing.

In the first tank, the shells are submerged in a hot soda-ash solution, which loosens any grease or dirt left on them when they leave the washing machine. Then they are dipped into a hot water rinse, after which they are lowered into a tank containing a soda solution, which is charged with direct-current electricity, and next into another tank, where the direction of the electric current is reversed. These electrolytic cleaning tanks constantly discharge bubbles of hydrogen gas, as they remove oxide from the shells. When each shell leaves the second electric cleaner tank, a man removes it from the conveyor and scrubs it thoroughly with pumice stone. He then rinses it with a water spray and replaces it on the conveyor, which carries it successively into a muriatic solution and into two cold-water rinsing tanks.

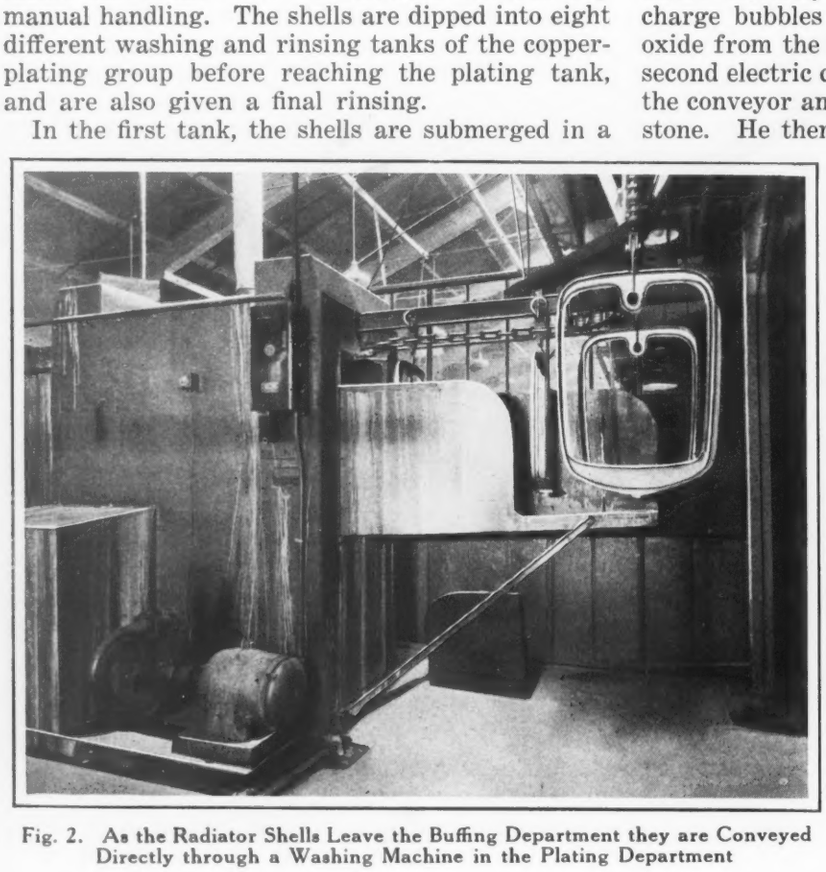


Fig. 2. As the Radiator Shells Leave the Buffing Department they are Conveyed Directly through a Washing Machine in the Plating Department

The Copper-plating and Nickel-plating Operations Both Last Twenty Minutes

The radiator shells are now thoroughly clean, and are carried automatically by the conveyor into the copper-plating tank. An important feature of this tank is the use of compressed air for agitating the plating solution, thus carrying away any dirt from the place where the shells are submerged. A final hot rinse after plating dries the shells. The time that the shells spend in the various tanks of the copper-plating group is shown in the accompanying table. The temperature of the copper-plating tank is held at about 100 degrees F.

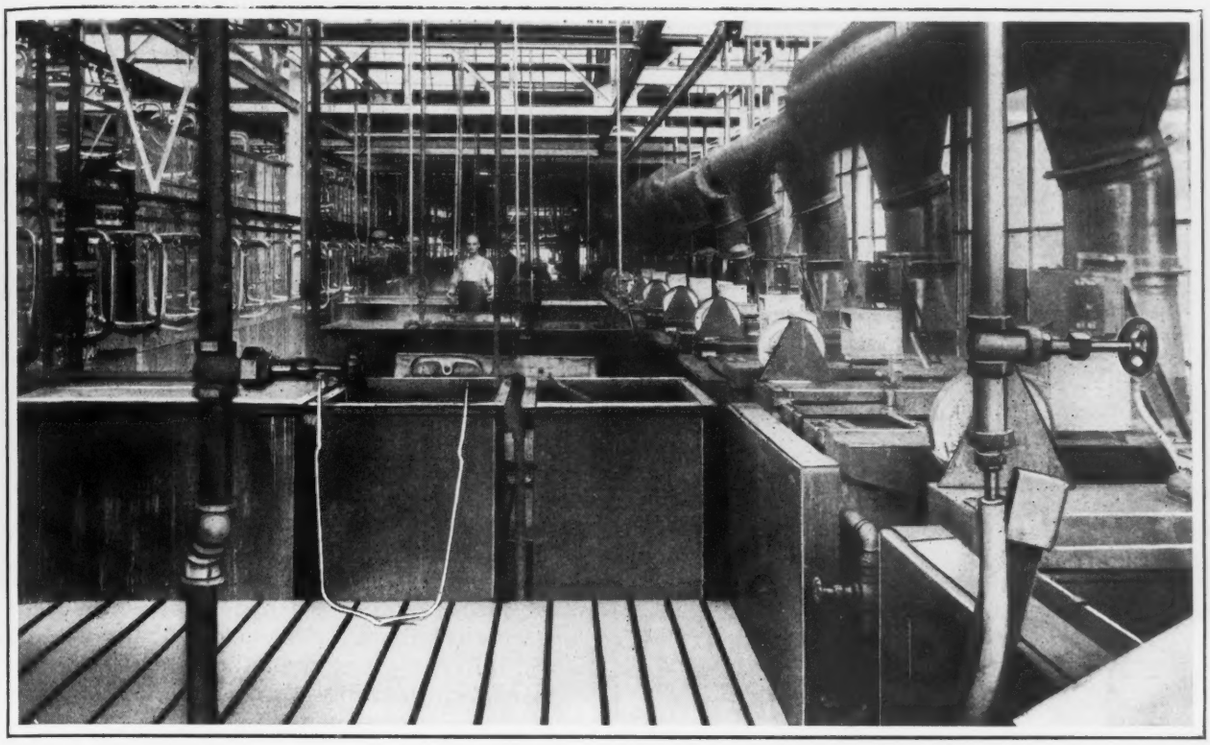


Fig. 3. General View of the Glass-enclosed Plating Department Taken from the Chromium-plating End

When the parts reach the end of the copper-plating group of tanks, they are unloaded from the conveyor by an attendant who immediately hangs them on a third conveyor that carries them back to the buffing department. Here they are buffed again on cotton wheels with "Snowhite" buffing compound, after which the buffers replace the shells on the conveyor, and they are carried back to the loading point. Next they are hung on the same conveyor that carried them through the tanks of the copper-plating group and that now carries them automatically through a similar series of washing and rinsing tanks prior to being subjected to the nickel-plating process, and also through this process.

The tanks of the nickel-plating group are arranged beside the copper-plating group of tanks, as may be seen in the heading illustration. The nickel-plating solution is held at a temperature of 80 degrees F. In the accompanying table is also given the sequence of the baths in the nickel-plating process and the time spent by the radiator shells in each bath.

At the completion of the nickel-plating, the shells reach the point where they were originally loaded on the copper-plating conveyor as they were taken from the conveyor that brought them from the buffing department and through the washing machine. They are now put on the first conveyor again, and carried back to the buffing department. After a third buffing, the shells are hung on a fourth conveyor which carries them to the chromium-plating section shown in Fig. 3. Radiator shells can be seen passing through this section in two lines at the left.

Various small parts that are copper- and nickel-plated are carried through these processes by suspending quantities of the parts from the conveyors on wires. All the copper- and nickel-plating equipment described, as well as the cadmium-plating equipment, was installed by the Hanson-Van Winkle-Munning Co., Matawan, N. J.

Chromium-plating Section a Model of Cleanliness

Concrete flooring in the copper- and nickel-plating section of the department facilitates keep-

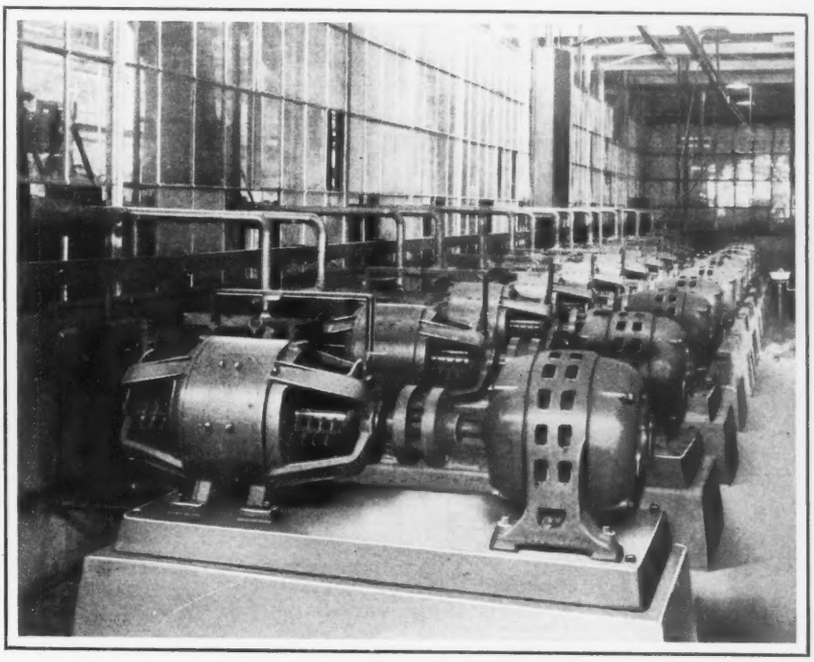


Fig. 4. Battery of Ten Motor-generator Sets which Provide Electric Current of the Proper Voltage and Amperage to the Chromium-plating Tanks

ing the department clean and dry. In the chromium-plating section, the shells are immersed manually in the various tanks, by operators standing on raised platforms. These platforms are constructed of wooden boards with cracks between the boards wide enough to insure drainage of water dripped from the shells.

In the chromium-plating operation, the shells are first dipped in a cold-water tank; then into a muriatic bath; next, into a lukewarm water rinse; and finally, into the chromium-plating tank. They remain in this tank about 1 1/2 minutes and are then dipped into a "drag" tank which collects most of the excess chromic acid for future use, after which the shells are placed in a tank where about 500 streams of cold water strike them from all directions. After a rinse in hot water to hasten drying, the shells are hung on a conveyor and carried from the department. It will be understood that each shell is handled individually in the chromium-plating process.

Data Relating to the Copper- and Nickel-plating Processes

Bath	Minutes Spent in Tanks, Copper-plating	Minutes Spent in Tanks, Nickel-plating
Hot Soda-ash	5	4 1/2
Hot-water Rinse	2	2
Electrolytic Cleaner	4	2
Reverse Electrolytic Cleaner	2	1
Muriatic Acid	1	1
Cold-water Rinse	1	1
Cold-water Rinse	1	1
Copper Strike	..	1
Cyanide	..	1
Cold-water Rinse	..	1
Copper-plate	20	
Nickel-plate	..	20
Cold-water Rinse	..	1
Hot-water Rinse	2	1
Total	38	37 1/2

Machinery

In Fig. 3 the chromium-plating tanks, ten in number, are seen arranged along the right-hand wall with a fume exhaust system installed overhead. Each tank is equipped with an instrument board carrying a rheostat, voltmeter, ammeter, and thermostatic control. The temperature of the chromium tanks is maintained at about 113 degrees F. Fig. 4 shows the battery of ten motor-generator units which supply current of 9 volts, 1500 amperes to the chromium-plating solutions. The chromium-plating equipment was installed by the Plymouth organization. Generators for the copper-, nickel- and cadmium-plating tanks are installed in a separate room.

Upon the completion of the chromium plating, the radiator shells are carried by a conveyor to an inspector, who carefully examines the shells for defects in the plating. Rejections on the entire plating process amount to less than 2 per cent. Equipment is installed in the department for removing all plating from parts that are rejected, so that they can be run through the process again.

Many Small Parts are Cadmium-plated

Quantities of small parts are cadmium-plated in equipment located just beyond the chromium-plating tanks, as seen in Fig. 3. Parts to be cadmium-plated are dipped into two electrolytic cleaning tanks in the same way as the radiator shells prior to the copper- and nickel-plating processes, and are then rinsed. They are next dipped into muriatic acid, given two more rinsings, and placed in barrels which are submerged in the cadmium bath. These barrels are revolved in the bath for a period of from twenty to thirty minutes.

At the end of this time, and while remaining in the barrel, the parts are rinsed successively in cold and hot water and are then emptied into a drier employing steam-heated air. A screw conveyor carries the parts through this equipment.

* * *

CUTTING DOWN DIE-SETTING COSTS

By J. D. RELYEA

Sometimes a close study of indirect labor costs will show that substantial savings can be made by simple changes in methods or systems. A case in point recently occurred in a plant that makes a large variety of electrical devices. Owing to the many different lines manufactured, there was a tendency for large stocks of material to accumulate, with a corresponding expansion in inventory. The management made a determined effort to cut this down, and as a result, the foremen were kept busy getting out small orders and keeping material from accumulating in barrels or bins.

In the punch press department, one direct result of this practice was a considerable increase in the die-setting costs, owing to the large number of small-lot runs, jobs repeated only at infrequent intervals, and orders to make up shortages. The superintendent noticed this, and having some doubt as to the efficiency of this method of handling the die-setting work, put a time-study man on the job who devoted a full day to each of three die-setters, tabulating everything that they did. In the report submitted, the actual die-setting time was segregated from other activities. The final figures for the three men were as follows:

	Per Cent of Time Spent on Die-setting	Per Cent of Time Spent on Other Work
Die-setter No. 1	65	35
Die-setter No. 2	45	55
Die-setter No. 3	40	60

It was found that the "other work" included moving and placing material, taking dies to the tool-room for repairs, obtaining dies from the store-room, moving heavy bed-plates, cutting pieces for samples, moving the die-table and crane, trips of inquiry to tool-room and store-room, making out time tickets and tray slips, etc.

Costs were considerably reduced by confining the die-setter's work strictly to setting dies. Cheaper labor was used for the transporting of tools and work. By providing special tables for the dies, it was possible for most of the day's requirements in dies to be brought out from the store-room at one time. This part of the program was considerably facilitated by having the foreman prepare a list of the requirements each night for the succeeding day. The operators welcomed the changed conditions, as they had considerably less idle time. Production has been noticeably increased.

Milling Cutter Engineering

Examples of Milling Cutters Especially Designed to Meet the Requirements of Different Jobs—Second of Two Articles

By A. N. GODDARD, President
Goddard & Goddard Co., Inc.

EFFICIENT milling depends fully as much on using properly designed cutters as it does on employing machines of types and capacities that meet the requirements of the work. Many investments in high-priced milling machines have shown losses over a period of years, simply because this fact has not been appreciated. Careful consideration, therefore, should be given the different factors involved, when selecting cutters for any job. Frequently single-purpose milling cutters designed for the individual job are found most economical and efficient.

The Goddard & Goddard Co., Inc., Detroit, Mich., in addition to manufacturing a line of standard milling cutters, specializes in the designing and making of single-purpose cutters. The first article on this subject, in July MACHINERY, contained interesting examples of such cutters produced for a large variety of operations; other examples of the same general character will be given in this article.

Cutters for Producing 100 Slots Simultaneously

A section of a machine-steel rack having teeth similar in shape to those of a comb is shown in Fig. 1. This rack, in its total length, has 101 teeth which are produced by cutting 100 slots to a depth of 1/2 inch. The slots are 0.078 inch wide at the bottom for a straight rise of 1/4 inch. During the remaining 1/4 inch of height the slots taper gradually outward to give the tops of the teeth a width of 1/64 inch. Spacing of the teeth is held accurate to within plus or minus 0.0005 inch, and a cumulative error in the spacing is not permitted.

Two cuts are performed on each rack in forming the teeth. For these operations, the work is placed in a fixture which has holes laid out to fit dowel-pins on the tables of two milling machines. Thus, the fixture can be positioned accurately in alignment with the cutters, for the second operation, by means of the slots that were partly produced in the first operation.

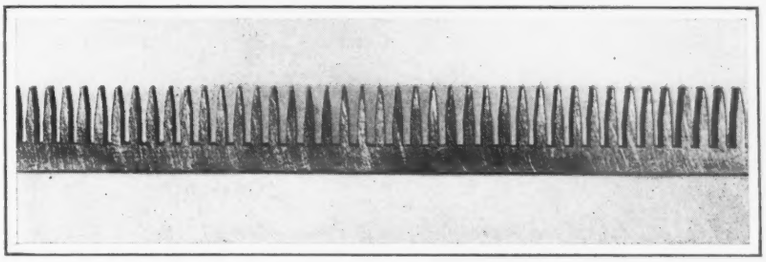


Fig. 1. Section of a Rack having 101 Fine-pitch Teeth which are Milled at One Time

The first machine is equipped with the gang of 100 formed angular cutters shown on the top arbor in Fig. 2, while the second machine is equipped with the gang of saws assembled on the arbor shown beneath in the same illustration. A finished rack may be seen below the second arbor. The angular formed cutters are 5 1/4 inches in diameter, and the saws, 5 inches in diameter. Both arbors are 2 1/2 inches in diameter. The center-to-center distance between the outside cutters of both gangs is 15.551 inches. Through the use of these tools the racks are produced without difficulty.

Side Milling Cutter with Teeth of Unusually Fine Circular Pitch

Westinghouse vacuum brake cylinders for automobiles are iron castings of a good grade, but owing to the quick chilling of the thin walls, they have unusually hard chilled spots over which the cutter must pass in milling the valve seat surface and clearance. For this operation, the special type of side-mill shown in Fig. 3 was designed. The principal feature of this cutter is the close spacing of the teeth. It is 4 inches outside diameter, 1 1/16 inches wide, and is carried by a stub arbor. Cuts are taken with a peripheral cutter speed of 70 feet per minute and with a table feed of 6 inches per

minute. Approximately 200 cylinders are milled per sharpening of the cutter teeth.

The operation is carried out on a production basis by employing the set-up shown in Fig. 5. Six cylinders are mounted in an inverted position on a special plate provided on the table of a No. 3 Milwaukee milling machine. The cylinders are located in the proper positions by means of disks of the same diameter as the cylinder bores. These disks are fastened to the plate, after which the bores are slipped over them.

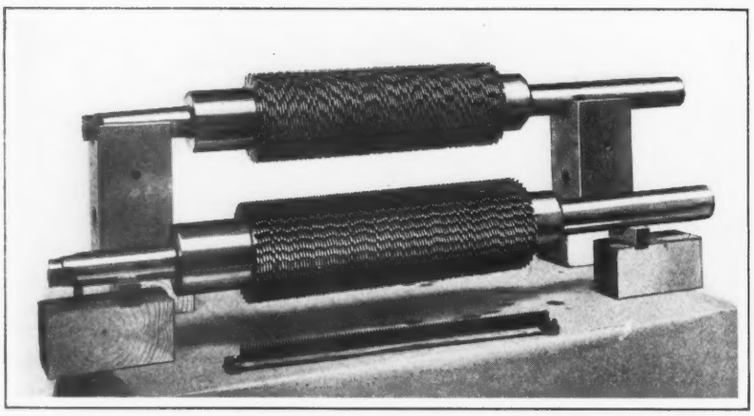


Fig. 2. Roughing and Finishing Cutters Used in Milling Rack Teeth of the Type Shown in Fig. 1

material is bronze. Thus, the problem in planning to mill this work was not only how to obtain the required accuracy, but also how to mill the work without tearing away any portion of the delicate fins, which would be very likely to happen with a stringy bronze.

Fig. 7 shows the cutter designed for accomplishing this operation on a vertical boring mill, equipped with a special milling head which holds the cutter suspended. The tool is made up of four sections of formed cutters, which are assembled with the teeth of each section offset a certain amount in relation to the teeth of the other sections, giving the unit a cutting action similar to that of a spiral tooth cutter. The teeth are arranged to take intermittent cuts for producing the fins and grooves, that is, one row of cutter teeth will mill every second groove across the work,

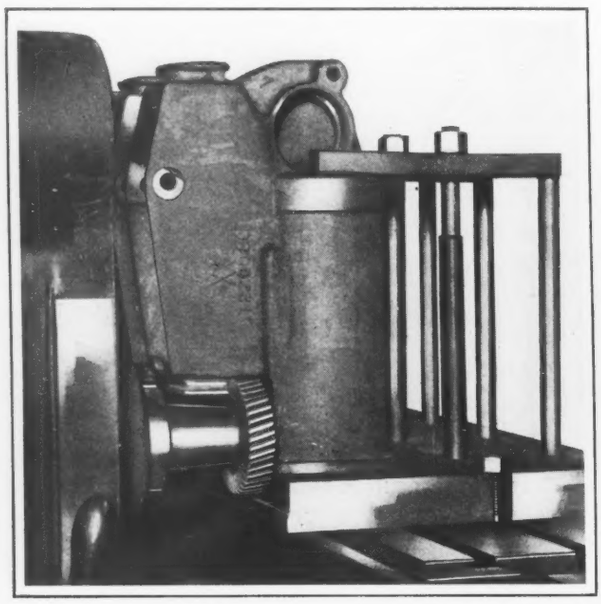


Fig. 3. Special Cutter Developed for Milling Iron Castings having Unusually Hard Chilled Spots

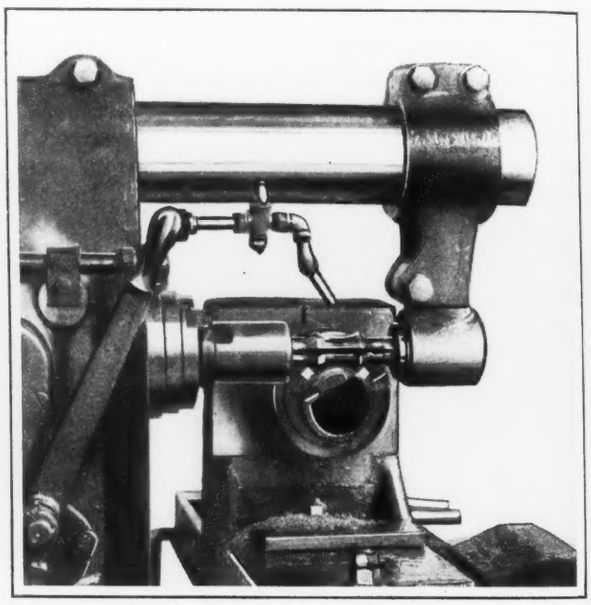


Fig. 4. Set-up Employed in Producing the Lugs on the Oil-well Pump Parts Shown in Fig. 10

Sectional Cutter with Staggered or Intermittent Teeth

Two cutters, a rougher and a finisher, are used in milling fins and their adjacent grooves, such as shown in Fig. 9, on the inside of large packing rings for rotor shafts. All decimal dimensions given in this illustration must be maintained within plus or minus 0.001 inch. The

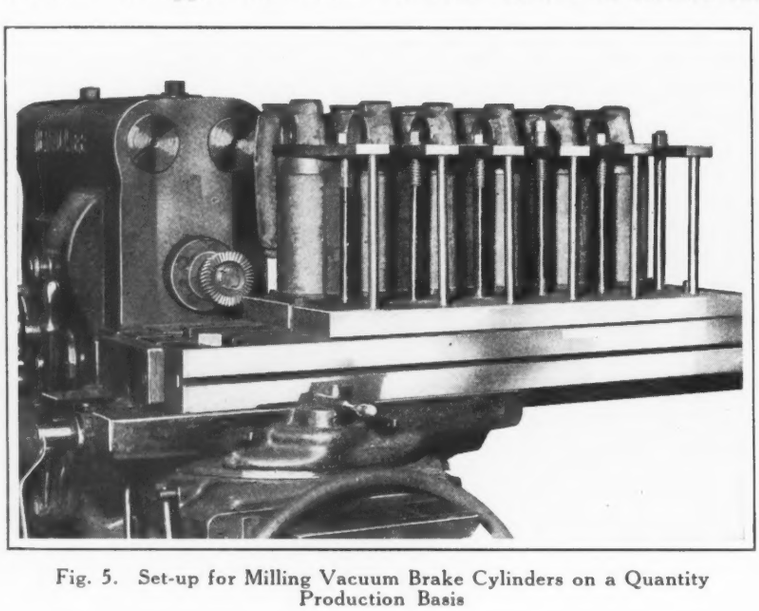


Fig. 5. Set-up for Milling Vacuum Brake Cylinders on a Quantity Production Basis

while the succeeding row will mill the grooves skipped by the previous teeth, and so on. The square shoulders at the bottoms and on one side of the cutter teeth mill off the tops of the fins and thus accurately establish their relative heights.

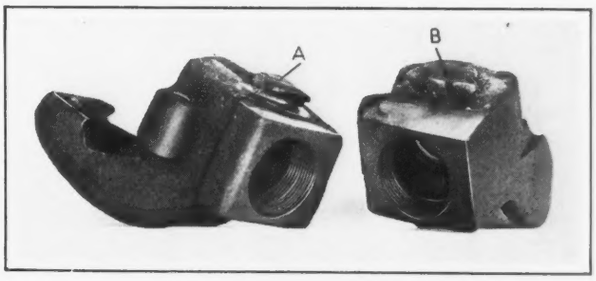


Fig. 6. Two Railway-car Steam-hose Connections, One Ready for Service, and the Other Welded, Ready to be Reclaimed by Milling

Roughing cutters are run in this operation at a peripheral speed of approximately 200 feet per minute, and the work is rotated at a feed of about 7 1/2 inches per minute. Finishing cutters are run at a peripheral speed of about 300 feet per minute, with the table rotating at a feed of approximately 12 inches per minute. The cutters are 5 inches in length.

Previous to the adoption of this milling practice for the packing rings, which has given very satisfactory and economical results, the fins were produced by using a formed tool in the boring mill. This method was very tedious and frequently resulted in the loss of work due to the tool tearing away some of the delicate fins.

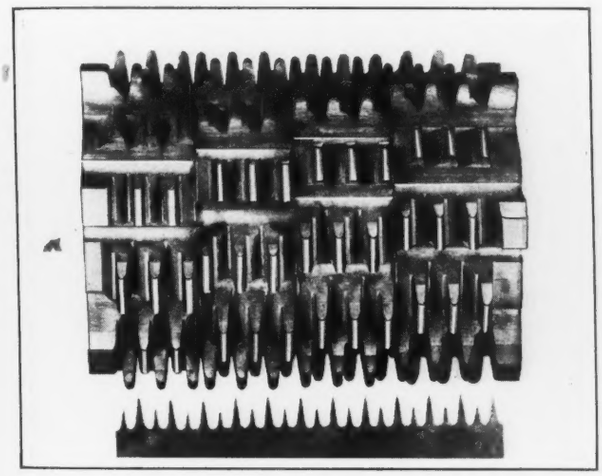


Fig. 7. Sectional Cutter with Teeth Positioned to Take Intermittent Cuts in Producing Fins of the Type Shown in Fig. 9

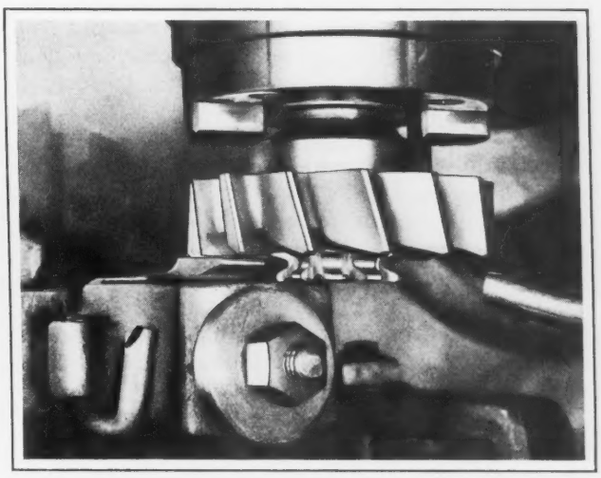


Fig. 8. Milling Cutter Designed for Reclaiming Railway-car Steam-hose Connections of the Type Shown in Fig. 6

Formed Cutter with Integral Staggered Teeth

Oil-well packer pumps of the types shown at *A*, *C*, and *E* in Fig. 10 have lugs that are produced by milling operations in which cutters of the type shown at *B* and *D* are employed. Some of the pumps have five lugs, others four, and others three. These lugs are produced by first turning the pumps in a lathe, leaving a solid ring as an integral collar on the piece. The ring is then milled away, with the exception of certain portions that form the lugs.

The location of the lugs is so close to the large body section of the pumps that it was believed that the only means of cutting out the ring to leave the lugs was an end-milling operation. Hence, this was the method first adopted, the work being held in a rotary fixture which was fed toward the cutter. This method, however, proved too slow and uncertain, and the Goddard & Goddard Co. was called upon to devise a more efficient method.

With the type of formed cutter shown at *B* and *D*, which was subsequently designed, the staggered teeth ease the cut and the cutter is small enough in diameter to permit milling away the ring for the lugs without interfering with the larger portion of the body. The work is held in a simple fixture on the regular table of the machine, as shown in Fig. 4, and is fed horizontally the required amount after each indexing. With this method, a satisfactory job on a five-lug pump is completed in a floor-to-floor time of 20 minutes, whereas when the old end-milling method was employed, one hour was required to perform the operation. It will be observed from the illustration Fig. 10 that the shank and pilot ends of this formed cutter are integral with the cutting portion.

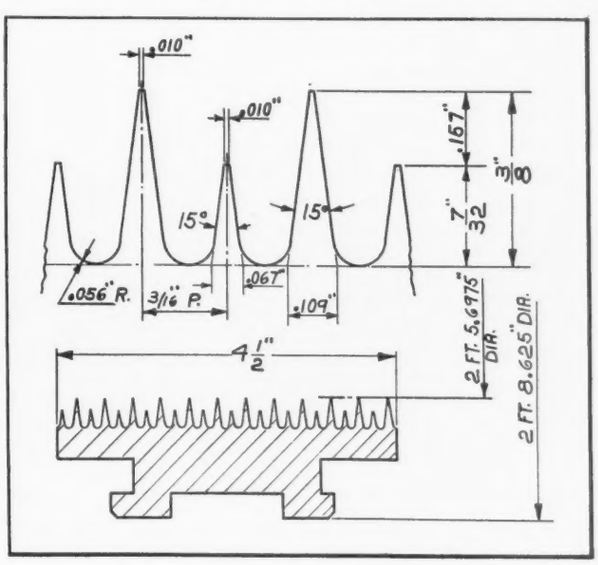


Fig. 9. Diagram Showing Fins Milled on the Inside of Large Rotor Shaft Packing Rings

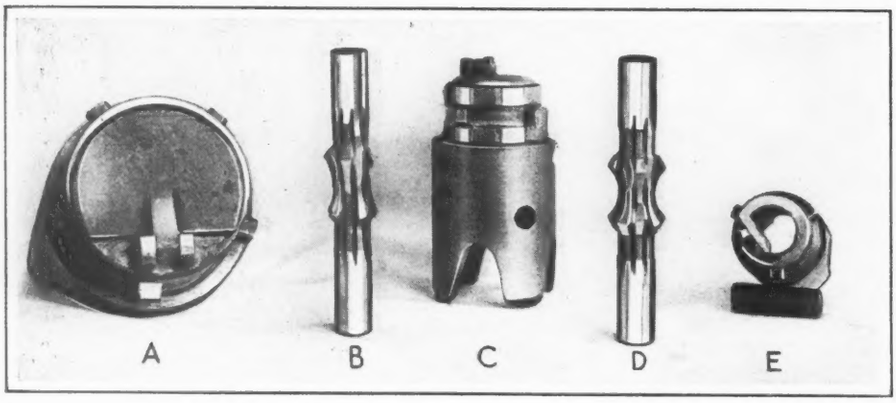


Fig. 10. Three Oil-well Pumps and Two Cutters Employed in Producing Lugs on the Pumps

Combination Facing Mill and Under-cutter

Passenger and freight cars of railroads employ steam-hose connections having a lug *A*, Fig. 6, which frequently breaks off in service and causes considerable loss. One tool supervisor recently conceived the idea that this loss could be reduced greatly by welding metal on the broken connections, as shown at *B*, and remilling this metal to form the lug.

Cutters such as shown in Fig. 8 were designed for this job, and the connections are now reclaimed in one shop almost by the ton. The work is held in a simple fixture provided on a standard circular milling attachment. Hose connections better than the original ones, because they are stronger, are produced at a rapid rate and at low cost by this method. Each cutter unit consists of two pieces, an outer half side-mill and an inner formed undercutting tool.

* * *

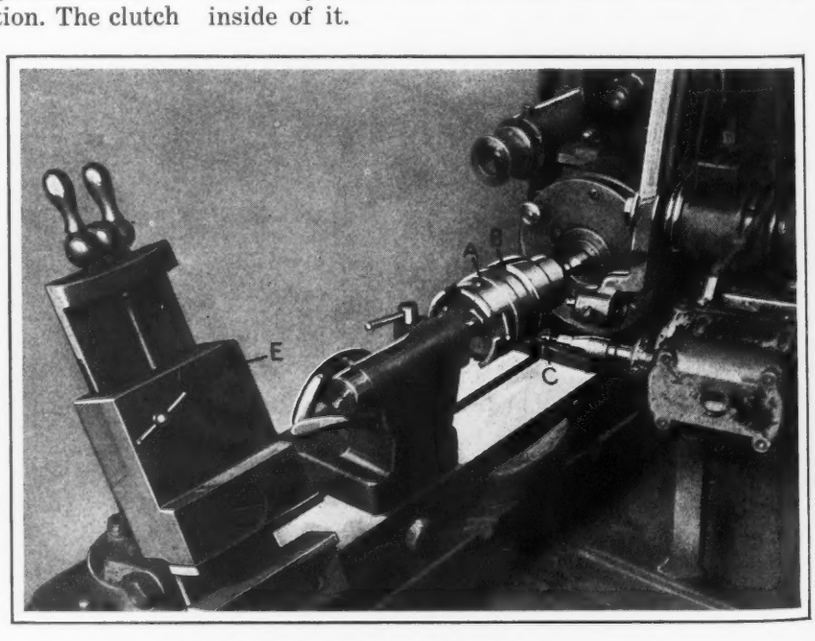
GRINDING HELICAL CLUTCH TEETH

By O. S. MARSHALL

The accompanying illustration shows a set-up employed in grinding the four helical contact faces of the clutch *A*. The lead of the ground faces is approximately 20 inches per revolution. The clutch is held on the lead-control mandrel *B*. This mandrel has grooves which serve to give the work the spiral movement required to grind the clutch faces to the proper lead angle. The length of the faces ground is 3/8 inch, and the width, 3/16 inch. A grinding wheel *C* with a face 1/4 inch wide is used.

The clutch faces are relieved at the inner end or shoulder face by a 1/4-inch hole which permits passing the small grinding wheel across the full length of the face. The grinding wheel, which is mounted on the spindle of a Dumore electric grinder, is run at high speed. The guide pin *D* engages the grooves that give the work the required spiral movement, and is located at the same height as the grinding wheel. The regular spindle of the grinding machine is used as a support for the guide-pin holder.

A truing diamond, not shown, which is used to keep the wheel trued up to the correct form, is held in the vise *E*. In performing the truing operation, the diamond is located directly beneath the grinding wheel and fed back and forth across the face to be trued. The clutch is clamped to the lead mandrel by a nut and washer. The machine stops are made use of to limit the travel of the work. The traversing movement is obtained by means of the hand feed.



Set-up for Grinding Helical Faces of Clutch Teeth

* * *

SALVAGING OLD ELECTRIC LAMPS

Burned out electric lamps are being salvaged by the New York Edison Co. through the employment of a machine especially built for the purpose. Only the brass shells at the end are worth saving, but the scrap metal value of these is sufficient to warrant reclaiming. In the past, the reclaiming method was to break the lamps by hand. They were put into a barrel rigged like a churn, with a plunger worked up and down. This was a slow process and too much material adhered to the brass shells.

The new machine consists of a motor-driven revolving steel cylinder perforated on the inside with holes not quite large enough to permit the brass shells to fall through. A barrelful of glass bulbs, perhaps 300 to 500 of all sizes, is poured into the cylinder. Loosely placed among the lamps are two long steel bars covered with prongs. As the cylinder revolves at high speed, these prongs knock the glass, filament, and cement loose from the brass shells. The broken waste falls through the holes in the cylinder and the clean brass shells remain inside of it.

Chromium-plated Molds for Bakelite Parts

Advantages Gained by Chromium-plating Molds—Points to Consider in the Application of Plating—Use of Plated Molds and Hobs

By C. R. GIVEN, Bakelite Corporation, New York City

ALTHOUGH chromium plating is relatively new, it has already been adopted as the regular method of finishing a great variety of products. Its application to tools, gages, and equipment used in manufacturing operations has proved advantageous in several instances. The extreme hardness, low coefficient of friction, and resistance to corrosion are characteristics of chromium plating which recommend its use on many molds employed in the production of Bakelite parts.

While chromium plating has been used to great advantage on certain Bakelite molds, such applications have not yet been conducted on a sufficiently extensive scale to warrant definite statements or conclusions regarding its possibilities or limitations in this field. However, the results already obtained indicate that this process will be extensively used in the future to improve the performance of molds used in producing Bakelite parts and dies employed in pre-forming Bakelite material into pellets or tablets ready for final forming in regular production molds. Hobs or punches used in forming the contours or cavities of duplicate Bakelite molds may also be improved by chromium plating.

The following information regarding the chromium plating of molds was obtained by the Bakelite Corporation, 247 Park Ave., New York City, for the guidance of those engaged in molding Bakelite. The chief chemists of concerns interested in the development of the chromium-plating industry and men who have had practical experience in the use of chromium-plated molds supplied the information on which this article is based. So far as possible, care has been taken to avoid presenting any information that has not proved to be correct by actual practice.

Life of Molds has been Increased from Ten to Fifteen Times by Plating

The principal object in chromium-plating molds is to increase the durability of the molding surfaces. In the case of molds, hobs, or pre-forming dies, the chromium plating should be applied directly to the hardened steel surfaces. Under coats of other metals, such as copper and tin, tend to reduce the durability of the chromium plate. The mere plating of a hob or mold will not, of course, prevent breakage resulting from faulty hardening.

The tendency of Bakelite molding powders to impart a polish to the mold is less noticeable on chromium-plated molds. In other words, the powders have less effect on the chromium plating than on the hardened steel surfaces. For this reason, a mold that has been given a matted or sand-blasted surface in order to produce a dull finish on the molded part will retain the required finish for a much longer period than a non-plated hardened steel mold. Some molders state that the life of a matted surface has been increased ten to fifteen times by chromium plating.

Release of Parts from Plated Molds

There is little doubt that a molded piece can be more easily released or discharged from the cavity of a mold that has been chromium-plated. Experience has shown that parts with molded threads can be more easily unscrewed from a mold that has been chromium-plated than from an unplated mold. It is also claimed that less trouble from sticking is experienced in hobbing a series of mold cavities with a plated hob. A thin plating is considered better than a thick one for a hardened steel hob.

It is possible to build up the surface of a mold by chromium plating when it is necessary or desirable to make slight changes in the dimensions of the molded piece. Generally, from 0.0002 to 0.002 inch can be added to the mold surface. The thinner plating, however, has greater strength and is less brittle. This factor must, of course, be considered in building up a surface, particularly in the case of hobs made for severe service.

Finish Obtained with Chromium-plated Molds

A mold that is to be chromium-plated must be polished just as carefully as an unplated one. The surface of the chromium plating is merely a duplicate of the surface to which it is applied in so far as the finish or polish is concerned. If there is any increase in the luster of the finish imparted to the work, it is negligible. Any defects such as scratches or tool marks on the part plated, will be somewhat accentuated in the plated surface.

The chromium plating itself may be polished, however, but it is more economical to give the underlying surface the desired polish or finish. There are various preparations on the market that can be used for such polishing operations.

A Chromium Plate 0.0002 or 0.0003 Inch Thick has Proved Sufficient for Good Results

Absolute uniformity in the thickness of chromium plating is not commercially practicable. The throwing power of chromium-plating solutions is low, compared with that of other metals. For this reason, the deposition of a plate of uniform thickness depends largely upon the nature of the surface being plated.

On relatively flat surfaces, the thickness of the plating will be quite uniform. If the work has deep recesses, special means must be employed, such as providing formed anodes that correspond with the shape of the cavity, in order to compensate for the poor throwing power of the solution.

On properly hardened hobs, a plate of 0.0002 or 0.0003 inch is sufficient for good results. Thicker plates up to 0.001 inch may be satisfactory, but are

more likely to be damaged. Chromium is not a substitute for a hardened surface. A thin chromium plate on hardened steel is better than a thick plate on a softer steel. The plating applied to a mold may vary from 0.0002 to 0.001 inch. The greatest variations may be expected on sharp corners and in small recesses, the tendency being to build up the sharp corners and to deposit less metal in the cavities.

Chromium Plating Helps to Prevent Rusting

An important advantage gained by chromium-plating molds is protection against rusting. This is especially important in the case of molds that are allowed to stand idle for a considerable length of time. Chromium plating should not, however, be considered a positive protection against rusting. If chromium-plated molds or tools are to be stored away for a considerable length of time, they should be well greased or kept in a dry heated vault.

Cleaning Used Molds

It is possible that difficulty will be experienced in plating used molds, the surfaces of which have become affected by the material molded in them. This trouble has been experienced from time to time with molds used in forming rubber. In such cases, it is generally necessary to refinish the surfaces slightly in order to eliminate the affected surface. It probably is best to have this work done in the tool-room by the diemaker rather than in the plating room or polishing department. In most cases, this work consists simply of a polishing operation which does not materially change the dimensions of the mold.

Specifications for Plating Work

It is practically impossible to give definite figures regarding the cost of chromium plating. The art is still new and there is much to be learned about it. Chromium plating is more complicated than nickel plating and the cost is higher. When molds are to be plated, the thickness of the plating required, together with the permissible variations in thickness, should be specified. The plater should also be given some idea as to where the thickest plating is desired when there is any preference in this matter. The plating should be done directly on hardened steel. The harder the under surface, the better will be the results obtained. Allowances for the thickness of the plating should be made in the dimensions of the mold when exceptionally close work is required.

Summarizing, the principal advantages gained by chromium plating are the increased durability of the surfaces against abrasion, wear, scoring, etc. Chromium plating also facilitates the release of the parts from the molds. It is rust-resistant to a high degree, and permits the building up of under-sized parts of the mold, to a reasonable extent.

Special Tools and Devices for Railway Shops

Equipment Employed in Locomotive Repair Shops, Selected by Railway Shop Superintendents and Foremen as Good Examples of Labor-saving Devices

REPAIRING LOCOMOTIVE STEAM PIPE

By L. M. TUTHILL, Production Department, Chicago, Burlington & Quincy Railroad

The methods of handling steam pipe repairs described here are employed by the Havelock, Neb., shops of the Chicago, Burlington & Quincy Railroad. In Fig. 1 is shown a set-up for grinding in the joint of a dry pipe and tee head. The pipe is placed in position by means of a crane. After the set-up is made, the grinding is taken care of by one man.

The tee head is located in a pit, with the joint to be ground slightly above the floor level. The dry pipe is supported in a vertical position by a steadying yoke at the top end, which is provided with light balancing springs of the coil type. These springs allow the pipe to sway at the top and give the ball joint a rolling motion which assists in grinding.

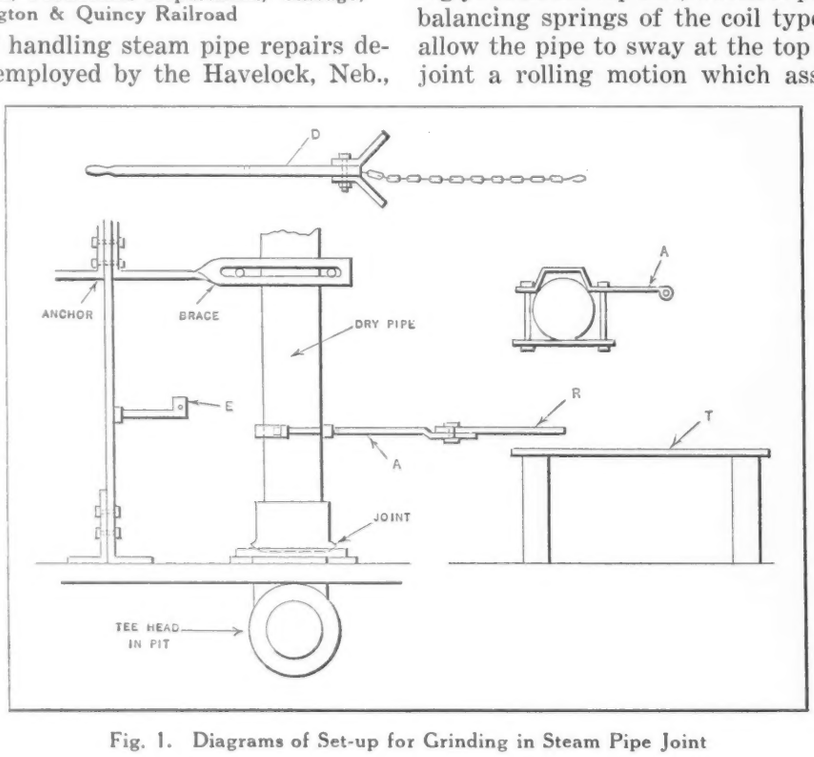


Fig. 1. Diagrams of Set-up for Grinding in Steam Pipe Joint

At *A*, is a lever clamped to the pipe. A link *R* connects the outer end of lever *A* to the oscillating arm *B* of the mechanism shown in Fig. 2. This mechanism is mounted on table *T*, Fig. 1, and is driven by an air motor, which is supported by means of the vertical bracket *C*, Fig. 2. Lifting lever *D*, Fig. 1, is placed on the fulcrum pin *E*, and is employed

by the operator to lift the dry pipe during the grinding process to enable him to inspect the joint. The chain of the lifting lever is simply looped around the pipe below the lever *A*.

Carborundum mixed with white lead which is thick enough to hold the abrasive in suspension is employed as a grinding compound. The time required to set up the pipe, grind, and replace it in its rack is from 50 minutes to 1 hour. This represents a time saving of 66 per cent over the old method.

The design of the oscillating mechanism is shown quite clearly in Fig. 2. The shaft *F*, driven by the air motor, has a pinion *G* at its lower end which meshes with the gear *H*. Gear *H* has a driving pin *I* fitted with a block *J*, which, in turn, is a sliding fit in the forked arm *K* secured to bar *L*. The bar *L* is thus driven first in one direction and then in the other by the crank motion of pin *I*. Teeth cut in one side of bar *L* mesh with a gear segment *M* to which is attached the arm *B*. This arrangement gives the arm *B* an oscillatory motion which is imparted to lever *A*, Fig. 1, by the connecting link *R*.

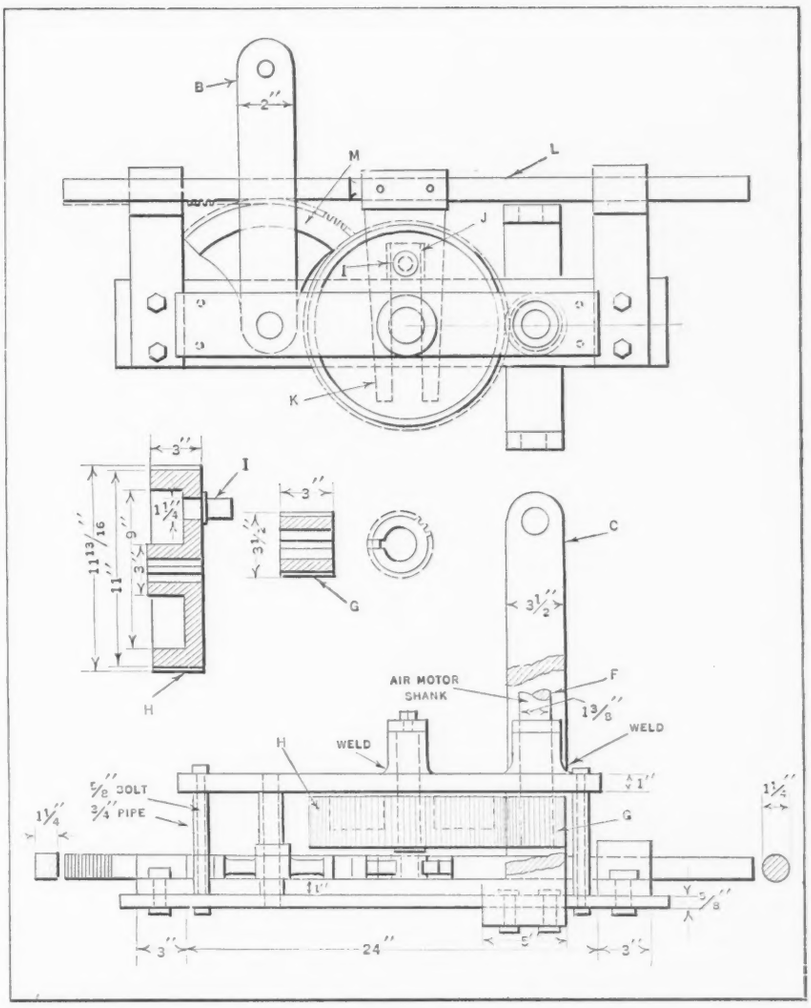


Fig. 2. Air-operated Oscillating Mechanism Used with Set-up Shown in Fig. 1

A Portable Reamer for Steam Pipe Joints

A portable reamer for steam pipe joints, which is driven by an air motor, is shown in Fig. 3. The reamer is held in position by a plug, which is slightly smaller than the hole in the steam pipe. After placing the reamer in position, the nut *A* on the tapered shank bolt is tightened, which causes three jaws to expand and grip the inside wall of the pipe.

The inserted cutters *B* of the reamer are forced against the face of the pipe by turning the knurled ring *C*. The method of driving the reamer by means of the air motor is clearly shown in the illustration. The average time required to set up the reamer, face, or ream the pipe joint, and remove the equipment is ten minutes, which is less than the time ordinarily required to take the pipe to the shop and return it.

Grinding Spool Type Valve

The grinding of double-jointed spool type throttle valves can be easily and quickly accomplished by employing an air motor and a simple work-stand. The valve chamber is mounted on a stand of convenient height made from scrap iron and steel plates. The valve is driven by an air motor, which is connected with a mandrel extending 3 inches below the valve chamber.

A foot-lever with its projecting end directly under the mandrel provides a convenient means for raising the valve slightly at frequent intervals during the grinding operation. The lifting of the valve in this way causes the grinding compound to be more evenly distributed and prevents seizing. Carborundum is used to break the scale, and a commercial grinding compound is employed for finishing. The average time required to complete the grinding of a throttle valve of this type is 1 1/2 hours. A simple fixture which permits assembling the throttle rigging in position for checking the action or operation of the valve is located at one side of the grinding stand.

Closing Dry Pipe Ends for Hydrostatic Tests

After a locomotive dry pipe has been hammer-tested, it is subjected to a hydrostatic test at pressures ranging from 250 to 300 pounds. In Fig. 5 are shown methods of closing the ends of dry pipes, so that the pipes can be tested by admitting water at the required pressure. A double thickness of plate is used at the front end of the pipe. Bolts pass through the outer plate only, as there is a tendency for the plate to buckle when the clamping nuts are tightened. This insures a perfect bearing on the fiber gasket which is used between the inner plate and the end of the pipe.

A solid ball joint ring with a fiber gasket is applied to the back end of the pipe. This ring is provided with a pipe connection and air vent valve. The slotted holes in the pressure plate permit it to be applied to pipes of various sizes. It will be noted

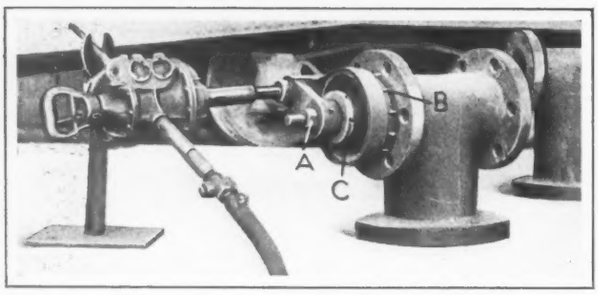


Fig. 3. Portable Reamer for Pipe Joint

that the clamp shown at *A* exerts pressure against the joint ring on the sleeve. This allows any cracks in the fillet to open under pressure, whereas if the clamp were applied to the pipe in back of the sleeve, the tightening of the pressure plate against the front side would tend to close the crack and thus permit it to go undetected.

Gage for Obtaining Steam Pipe Measurements

In ordering a bottom steam pipe ring for locomotives, it is important to obtain accurate measurements of the steam pipe and the height of the tee head or superheater from the pipe joint on the cylinder. These measurements can be easily obtained by employing a set of adjustable trams or gages such as shown in Fig. 4. The gage shown in the upper view is used to measure the center-to-center distance between the top and bottom ends of steam pipes. The lower view shows the gage used in measuring the distance from the center of the dry pipe tee head to the center of the steam pipe seat in the saddle.

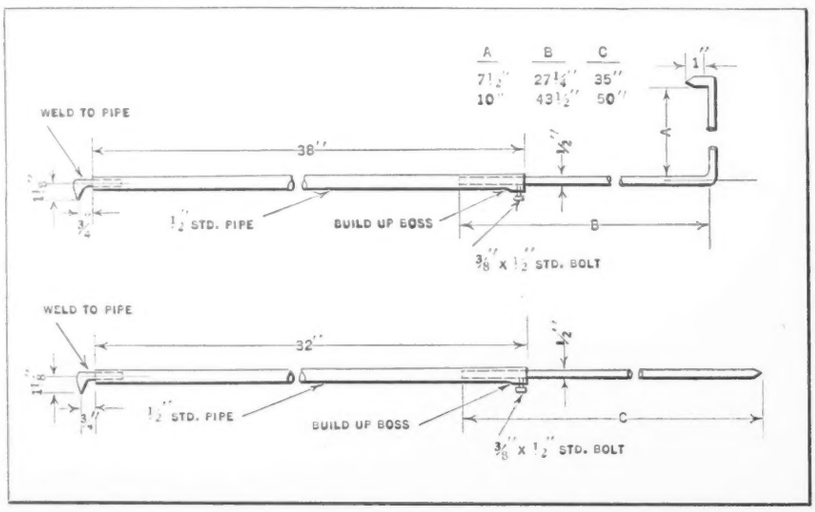


Fig. 4. Gages Used in Obtaining Measurements for Steam Pipes

After the tee head or superheater header is in position, a small stick is placed in the tee head in a crosswise position at the joint of the pipe. Another stick is similarly located at the saddle joint. Points that are concentric with the hole in the pipe are next located on the sticks. The gage shown in the upper view is then adjusted to gage the distance between the two points. Sticks are also placed on the top and bottom ends of the steam pipe, their centers marked, and the other gage set to gage the distance between the points on the sticks. The thickness of the bottom joint ring is equal to the difference between the set length of the two gages plus the height of the ball joint, provided the measurement indicated by the first gage is greater than that of the second. If the first measurement is less than the second, it is an indication that the steam pipe is too long.

SOUTHERN PACIFIC INSTALLS NATURAL GAS

By CHARLES W. GEIGER

Oil, coal, and gasoline have recently been displaced by natural gas in the railroad shops of the Southern Pacific Railroad at Los Angeles, Calif. Natural gas is now being used for forging, brazing, rivet heating, mold drying, sand drying, soft metal melting, brass melting, paint removal, tire-setting, and for firing locomotives in getting up steam. For these purposes, the Southern Pacific Shops will use approximately 640,000,000 cubic feet of gas a year.

Gas has especially proved its practicability for rivet heating and for firing locomotives. Formerly oil and gasoline were used for heating rivets, but owing to the irregularity of these heating methods, heavy losses in rivets were suffered. Actual checks made since gas was installed show that the rivets now saved more than pay for the fuel used.

In firing locomotives after inspection in the roundhouse, the Southern Pacific reports a saving of $2000 a month. Prior to the use of gas, steam was taken from the boiler plant of the roundhouse. In order to use natural gas, it is only necessary to attach a gas line to a torch in the firebox. This method effects a saving in time and eliminates the smoke nuisance and fire hazard from oil drippings. Approximately 10,000 cubic feet of gas an hour are used in getting up steam for one engine.

In every process in which natural gas has displaced other fuels, the Southern Pacific reports better results at lower cost.

* * *

Airplanes, seaplanes, and amphibians exported from the United States during the first quarter of 1929 had a value of over $1,100,000—a 100 per cent increase over the same period last year. Mexico, Chile, and Argentina were the chief purchasers.

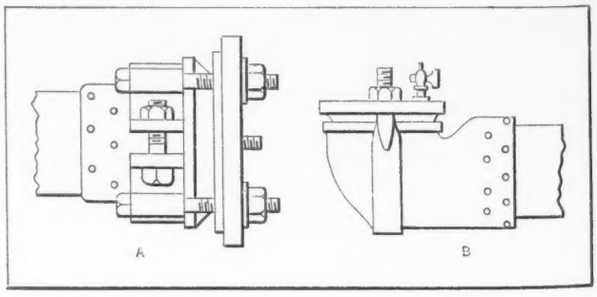


Fig. 5. Methods of Closing Dry Pipe Ends for Hydrostatic Tests

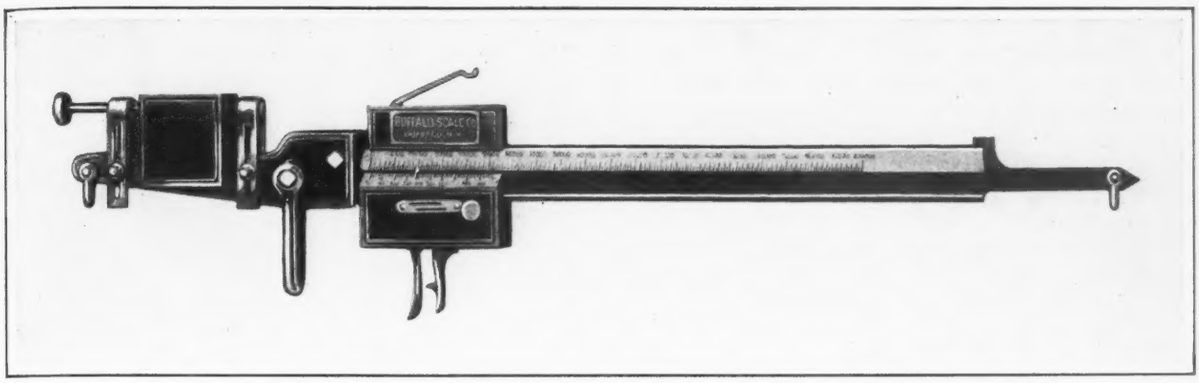


Fig. 1. Scale Beam Equipped with Attachment for Making Permanent Record of Weight

Weighing Methods that Cut Factory Costs

Types of Scales Adapted for Industrial Use, Together with a Number of Applications in Machine Shops and Shipping Departments

By J. W. ROCKEFELLER, Consulting Engineer, New York

ALTHOUGH some type of scale or weighing machine is in service in practically every manufacturing plant, comparatively few factories are equipped with all the types required to handle their work on the most economical basis. The scale used for the weighing of parcel post and express packages is generally considered a necessary adjunct of the shipping room. The parcel post scale that mechanically computes the necessary postage is in common use in practically every large plant that either manufactures or handles merchandise.

Carelessness in making parcel post shipments and lack of proper weighing equipment in many plants makes it necessary for the post office to maintain departments devoted solely to the purpose of caring for packages bearing inadequate postage. Manufacturers may suffer considerable losses from this source, through the resulting delay in shipments.

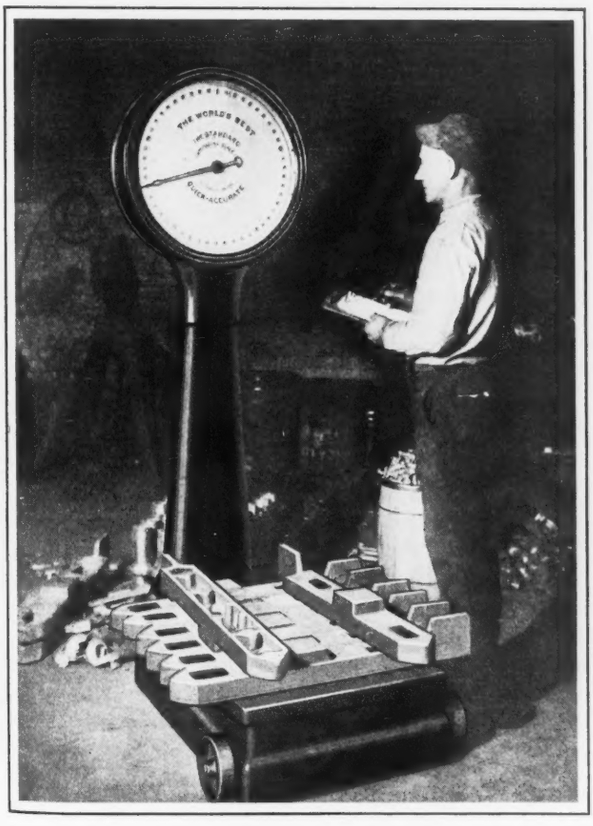


Fig. 2. Spring Indicating Balance Type of Scale Constructed for Heavy Duty

Fig. 3. Scale which Automatically Counts Number of Pieces Put in Container

Losses Due to Careless Weighing

Unfortunately, the losses of a manufacturer due to careless weighing or inadequate scale equipment are not confined to the shipping room. It is, indeed, an unusual factory in which a material saving cannot be effected by the introduction of proper scale equipment for weighing, counting, or testing material in various stages of manufacture.

In the receiving department where incoming shipments are checked by weighing, a faulty scale may be the cause of an actual monetary loss on every shipment received. Again, the scales may be accurate but of such a type that more time is required for weighing than would be the case with different equipment, and the waste of labor involved may be even more serious than the small over-payment for goods resulting from slightly inaccurate weighing.

Use of Portable Platform Scales

The type of scale most commonly used in industrial plants is the portable platform scale on which goods are weighed by means of counterweights in conjunction with a sliding poise on the scale beam. Usually, the chief recommendation of such a scale is its low initial cost and the fact that it serves a definite purpose well.

Where comparatively few parts are weighed and the cost of a more expensive scale is not justified, the ordinary beam type of platform scale is the logical choice. If such a scale is checked frequently to make sure that it has not become defective through rusting or wearing of the pivots or through the introduction of friction in working parts, its accuracy may be depended upon and it will give a good account of itself in service. In Fig. 1 is shown a beam scale equipped with a device for making a permanent record of the weight.

Under conditions requiring frequent weighing, the most practical equipment is the automatic indicating scale. This type of scale indicates directly the weight of the material placed on the platform and eliminates the necessity for manipulating counterweights and poise weights. In Fig. 2 is shown a spring indicating balance constructed for heavy work.

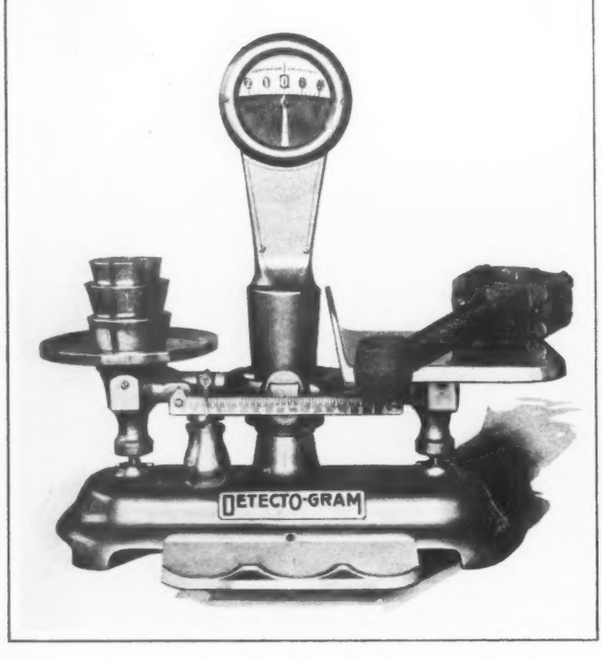


Fig. 4. Scale Used in Checking Parts which Must be Held to Exact Weight within Close Limits

Pendulum and Spring Type Scales

The dial scale is usually of the pendulum or spring type. In this type of scale, the weight of the part placed on the platform is shown directly on the dial of the scale by means of a pointer. While it is not claimed to be as accurate as a scale made on the equal arm principle embodied in a laboratory balance, it is accurate enough for commercial weighing, and its use results in an appreciable saving of time.

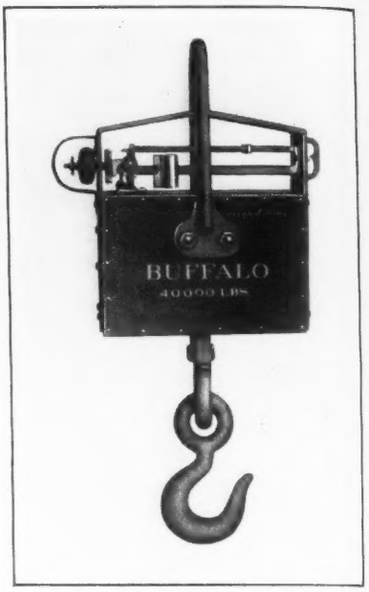


Fig. 5. Crane Scale of the Beam Type

The pendulum type of scale operates on the principle of counterbalancing a weight attached to the end of a swinging arm. The movement of this weight is translated to the indicator on the dial by means of a tape and cam. The operation of this type of scale, as well as the spring type of direct-reading scale, is usually hastened by employing a dashpot; this ordinarily consists of a plunger that travels up and down in a cylinder containing oil, although air dashpots in which a graphite plunger is used have been successfully employed for this purpose.

The spring type direct-reading scale, owing to its rugged construction and wearing qualities, has, during the last ten or fifteen years, made a decided place for itself in industrial weighing. When used under conditions of wide temperature variations, the slight change in the properties of metal parts is compensated for by employing a thermostat, the principle of which is the same as that used in an ordinary watch or clock to assure a high degree of accuracy.

The spring type of scale has a decided advantage for heavy work, in that the springs besides serving to indicate the weight on the platform, also, through their resiliency, absorb the shock of a suddenly imposed load, thus relieving the delicate parts of the scale from wear due to this cause. Spring scales have been used satisfactorily for heavy work in foundries and other places where scales of a different type have had very short lives due to the repeated shock of throwing heavy weights on the platform.

Advantages of the Counting Scale

A type of scale that has come into wide use in the factory for taking inventory and checking in-

coming shipments is the counting scale. Before the development of this machine, it was common practice, when taking inventory, to determine the average weight of the items to be counted by weighing one or several pieces on a fine balance. The total count was then determined by weighing the entire stock on a scale of greater capacity and determining the count by dividing this figure by the average weight of a single piece.

In order to eliminate the calculations required in such a procedure and to safeguard against the errors likely to occur when a large number of such calculations are made, the counting scale was developed. The principle governing the construction of most counting scales is the determining of the ratio between the total quantity on the platform of the scale and the single piece which is balanced against this material. In Fig. 3 is shown a counting scale used for inventory purposes in a large number of factories.

One or several pieces of the item to be counted are placed in the container, which is then moved along the "tare" beam until the scale is brought into balance. The markings of the beam show automatically the count of the material on the platform. Such scales are usually equipped with one or more additional tare beams which are used to offset the weight of the container that holds the goods to be counted.

Weighing Parts to Insure Proper Balancing

With the growth of the automotive and aircraft industries, the necessity for balancing the weight of reciprocating parts of engines has been emphasized. Fig. 4 illustrates an "over and under" scale, used for checking the weight of parts whose weight tolerance is but a fraction of an ounce. This type of scale is employed by a number of large automobile concerns in bringing connecting-rods and other reciprocating parts of the engine to exact weights.

In practice, a standard weight is placed on one platform of the scale as shown in the illustration. The part to be weighed is placed upon the opposite platform and a pointer which has a graduated dial as a background then indicates the weight in excess of the tolerance. By this means a workman is able to gage the amount of stock to be removed from the part in order to bring it to the specified weight, or to match several parts to be assembled in the same engine.

The circular dial type of counter scale is frequently used in the inspection of parts that must come within well defined limits with regard to weight. When used for this purpose, the dial is ordinarily equipped with indicators that may be set to show the maximum and minimum weights. In one factory using this method, it was found that in spite of such inspection, a number of pieces were being accepted that slightly exceeded the allowable tolerance. Upon investigation, it was found that this was due to a "human error" on the part of the inspector, who, by endeavoring to reduce the percentage of rejection to as low a figure as possible, was failing to reject pieces that were but a shade outside the given limits.

In order to eliminate this difficulty, the dial of the scale was equipped with two semicircular disks which could be so adjusted as to show only that sector of the scale within range of which the parts were acceptable. Under this arrangement, when a part was over or under weight, the pointer took up a position behind these disks, and it was impossible to tell whether the parts were a fraction of an ounce out or more than a pound out. This method worked out quite satisfactorily and eliminated the trouble previously experienced.

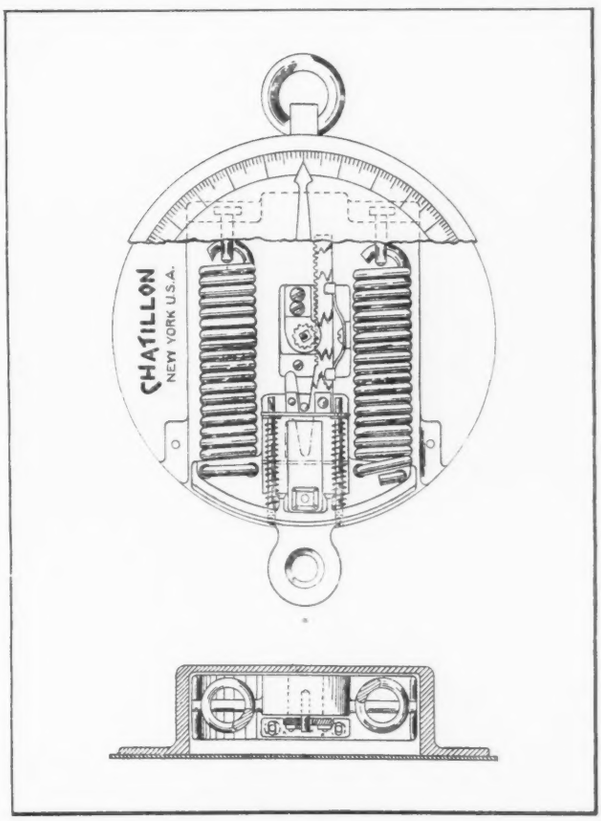


Fig. 6. Diagram Showing Small Counter Recoil Springs Used to Protect Rack and Pinion of Spring Balance from Damage

Saving Time by Weighing Object While Suspended from a Crane

It is often desirable to obtain the weight of material that has to be handled by a crane or hoist, and time is saved if the weighing can be done while the object is supported by the crane rather than by making the weighing a separate operation. A crane type of scale is shown in Fig. 5. Besides the crane scale illustrated, which is of the beam type, indicating scales are also used for this purpose.

When a spring type crane scale is used, it happens occasionally that through accident or otherwise, the load is suddenly released from the scale. This causes the entire counter force in the spring to be released, with the result that it recoils forcefully, often causing serious damage to the rack and pinion or the scale pointer. This has been overcome in one instance by a patented counter recoil device which absorbs this shock. The principle of this device is illustrated in Fig. 6.

The scales illustrated and described are all units in themselves and are used for the purpose of weighing or counting. Scales also play an important role in manufacturing as parts of testing ma-

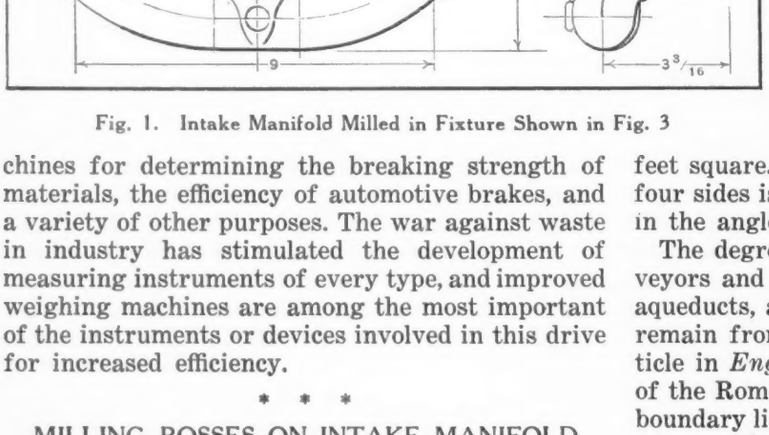


Fig. 1. Intake Manifold Milled in Fixture Shown in Fig. 3

chines for determining the breaking strength of materials, the efficiency of automotive brakes, and a variety of other purposes. The war against waste in industry has stimulated the development of measuring instruments of every type, and improved weighing machines are among the most important of the instruments or devices involved in this drive for increased efficiency.

* * *

MILLING BOSSES ON INTAKE MANIFOLD

The equipment used for milling the two small bosses on the intake manifold shown in Fig. 1 is illustrated in Fig. 2. The milling fixture, shown in detail in Fig. 3, is mounted directly on the table of a Cincinnati duplex milling machine equipped with special vertical spindle carriers. This arrangement permits both bosses to be milled at one time by the use of two side milling cutters. The elliptical flange on the manifold, which has been previously milled and drilled, is located in the fixture by two pins. The clamp, operated by the star-wheel, holds the work securely. To remove the work, the clamp is loosened and swung to one side. This fixture, although of simple design, is used in a large automobile factory with very good results on both large and small lots.

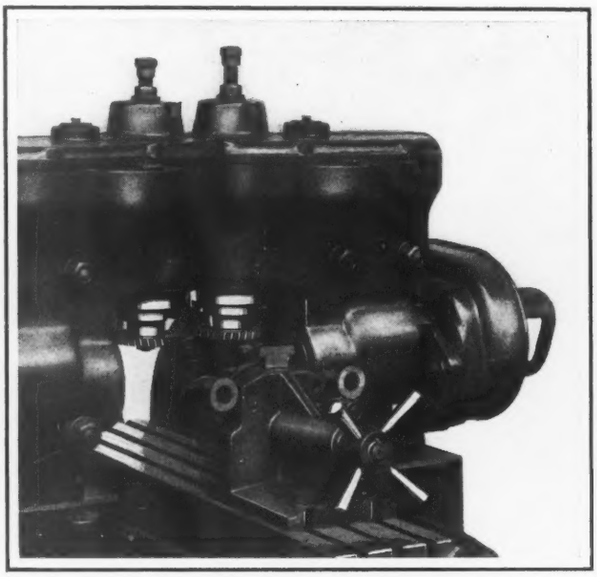


Fig. 2. Duplex Milling Machine Equipped with Vertical Spindle Carriers for Milling Manifold Bosses

* * *

An increase in the use of welding in the construction of buildings in the state of Pennsylvania is expected as the result of the passage by the legislature of that state of a law which allows this type of building construction to be used in the larger cities. There are two model codes available for the erection of welded buildings, one recently adopted by the American Welding Society, and the other, by the Pacific Coast Building Officials Conference. The latter code, although it has only been in existence two years, has been adopted by more than forty municipalities in the West and South.

ACCURACY IN ANCIENT ENGINEERING

Just exactly how the ancients were able to perform certain engineering work with the accuracy that they did is not known, but their methods, judging from the results of their work, were such as to insure remarkable accuracy of measurements. The Great Pyramid of Egypt, built some thirty centuries B. C., has a base 764 feet square. The mean error in the length of the four sides is only 0.6 inch, and the maximum error in the angle at the corners is 12 seconds.

The degree of accuracy attained by Roman surveyors and architects is evidenced by the bridges, aqueducts, amphitheatres, and other buildings that remain from that era. It is mentioned in an article in *Engineering* that one part of the frontier of the Roman Empire in Southern Germany has a boundary line 18 miles in length which was laid out over rough ground so straight that on resurveying with modern instruments, the mean error at any point does not exceed 6 feet in either direction.

Such precision, however, was not always attained. A tunnel for water supply, driven about the year 150 A.D. through a mountain in Algeria, illustrates this. The engineer, Nonius Datus, carried out the surveying and leveling, marked the axis of the tunnel across the ridge and drew plans of sections of the whole work, after which it was turned over to a contractor, the tunnel being driven from both ends. Writing about this at a later date, Datus states, "After four years' absence, expecting every day to hear the good tidings of the completion of the work, I arrived. The contractor and his assistants had made blunder upon blunder. They had diverged from the straight line, each section turning toward the right, and had I come a little later, they would have had two tunnels through the ridge instead of one." Datus resurveyed the work and put in a transverse tunnel connecting the two.

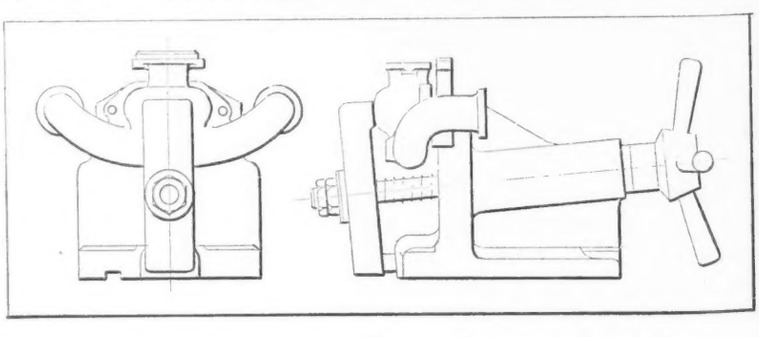


Fig. 3. Construction of Fixture Illustrated in Fig. 2

Notes and Comment on Engineering Topics

About one-half of the world's total production of tin is imported into the United States.

The taxes on the sale of 10,178,344,771 gallons of gasoline, collected in the United States for 1928, amounted to $305,233,842, according to the Bureau of Public Roads.

During 1928 the railroads scrapped over 3300 locomotives, more than 3000 passenger cars, and close to 87,000 freight cars. The locomotives and freight cars that replaced those scrapped were of much greater capacity than those that passed out of service.

The number of telephones in use in the United States was, according to the Bureau of Census, slightly over 18,500,000 at the end of 1927, the last date on which a census of telephones was taken. It is of interest to note that the number of automobiles in use in the United States exceeds by several millions the number of telephones.

In reviewing the Soviet-American trade for the last five years, the Amtorg Trading Corporation, New York, mentions that the value of machinery, raw materials, and other products purchased by the Soviet Republic in the United States during the last five years amounted to $398,000,000. Soviet products were sold in this country to a value of $105,000,000.

The Fiat automobile plant in Italy is said to be the largest plant in Europe under one roof. It consists of two parallel buildings, each five stories high, 1664 feet long, and 80 feet wide, united by three intermediate buildings. The two buildings are also connected at the ends. A rather unusual feature is the test or race track, located on the roof of the five-story buildings. The track is banked sufficiently at both ends to permit a safe speed of sixty-five miles per hour. The cars reach the track from a spiral ramp at both ends of the plant.

The *Journal of the Franklin Institute*, quoting a contemporary French publication, mentions some interesting experiments that have been conducted in France with rotating parts supported by air under pressure, instead of by direct metallic or other bearing surfaces. The stationary or supporting part has a hollow cone into which air is discharged under a pressure of about 85 pounds per square inch. The rotor is also of conical form, but the angle of its cone is greater than that of the stator or stationary part. With a rotor 1 3/4 inches in diameter, speeds up to 1300 revolutions per second were obtained. With a rotor about 1/2 inch in diameter speeds up to 11,000 revolutions per second were registered. It is difficult to comprehend that a rotating part about 1/2 inch in diameter can be revolved so fast that a point on its circumference travels at the rate of 840 miles an hour. The air under pressure that supports the rotating part is also used for producing the power to make it rotate. In other words, the rotating part is a miniature turbine.

Pipe joints in power plants are frequently made today by welding instead of by means of couplings. "Oxwelded" joints have been found very satisfactory for this purpose. Their increasing popularity is due not only to their being leakproof, but also to the fact that the maintenance cost is practically eliminated. The first cost is also reduced, because comparatively expensive fittings are no longer needed and no threading is required. The pipe may be purchased in 40-foot lengths at a saving, as compared with buying many short lengths. Additions to and changes in the piping system can also be made at very little cost.

Construction has been started on a new tunnel, 17 feet in diameter and 20 miles long, for supplying New York City with water. The work, which is to be completed in about six years, will be carried along on the same general lines as regular mining. Electricity will play a vital part in this vast undertaking. Compressed air for the drills and shovels will be furnished by 400-horsepower motor-driven compressors. Sixty-two 7-ton storage battery mine locomotives will be employed in conjunction with several 30-ton hoists at the shafts, while water seepage will be taken care of by motor-driven centrifugal pumps. The General Electric Co. will furnish the major part of the electrical motor-driven machinery.

A high-speed automobile truck equipped with Diesel engines has been placed on the market by the Linke-Hofmann-Busch-Werke of Breslau, Germany. The engines, of the four-cycle single-action type, are built with either four or six cylinders, developing 50 to 300 horsepower, and running at from 1000 to 1500 revolutions per minute. The weight of one type of engine with its flywheel, used in the heavy trucks, is 1100 pounds; it is 40 inches high, 51 inches long, and 28 inches wide. The design not only permits weight reduction, but facilitates dismantling for repairs. It is claimed that some of these engines have run up to 3000 service hours without attention. The engine may be operated with crude oil, liquid tar oil, or kerosene. One advantage claimed for these vehicles is the ease with which they can be driven through heavy traffic and in hilly country without shifting from high gear.

Current Editorial Comment

In the Machine-building and Kindred Industries

WATCH THE REPAIR COSTS

With a view to determining when it is good business to replace old machines, one large automobile company keeps a record of the cost of the repairs on each individual machine in the plant. The equipment engineer watches this record carefully, and when he sees that repairs are becoming frequent and costly, he determines, by actual cost figures, whether or not the machine ought to be replaced. As soon as it becomes evident that it would be cheaper to buy a new machine than to keep the old one in repair, a new machine is installed.

* * *

RATING THE ABILITY OF FOREMEN

The chief executive of one of the large companies in the automotive field has given a great deal of thought to the systematic training of foremen, and he also has developed a method of rating the qualifications of foremen that will prove of interest to plant managers in every branch of industry.

Under this system the following qualifications important to the success of foremen are listed: Technical ability, leadership, planning ability, initiative, cooperative ability, success in developing men, appearance and manner.

The foremen are rated by the general superintendent and the assistant superintendents according to a predetermined scale for each of these qualifications. They are told in a friendly and helpful way of their shortcomings, and suggestions are made for developing their abilities whenever their ratings are low. When promotions are made, these ratings greatly influence the selection of the men chosen to step into higher positions.

This system has proved successful during several years' operation. As the foremen are rated independently by a number of higher executives, the influence of any personal prejudice on the part of one man in particular is virtually eliminated. This method also affords a simple way of determining both the strength and the weakness of the organization, and helps the executive to develop it along strong lines.

* * *

CLEAR PRESENTATION OF FORMULAS

A great part of the information pertaining to machine design can be crystallized in mathematical formulas. The tools with which the engineer works are largely formulas, and it is, therefore, very important that the latter be made as simple as possible without sacrificing clarity. There are few faults in papers presented before engineering societies and in articles in the technical press that are more serious than the failure to state definitely and clearly what each symbol in a formula represents. This information should be given directly with the formula itself, and should be so arranged that it stands out in the text. If the formula, by necessity, is complicated, a completely worked-out example, showing its application to a practical problem, also should be given.

In a lengthy discussion important formulas should be given in a summary, either at the beginning or the end of the paper or article, so that an engineer may be able to choose the formulas he needs without going through their derivation in detail; and they should be arranged in such form that they can be applied by the user without it being necessary for him to read all of the text matter.

Engineers who prepare papers to be read before technical societies, and writers of articles for the engineering press, should train themselves in employing this method of presenting formulas, even though it may involve some repetition. Just as machine tools are the "master tools" of industry, so formulas are the "master" tools of the designer and engineer. Because of their importance, too much care cannot be taken in presenting them so that they may be conveniently used.

* * *

SOME SHOP LABORATORIES PAY BIG DIVIDENDS

It is only during recent years that medium-sized shops have installed shop laboratories, as the cost of maintaining them in any but the largest shops was formerly considered an unwarranted expense. If the chemical composition or the strength of a piece of material had to be tested, it was generally sent to a consulting chemist or to the laboratory of an engineering school.

Recently several medium-sized shops have installed testing laboratories and have found that they are justified in so doing. In one shop making a precision product that had to be hardened, there was until recently no testing laboratory. The product was submitted to a rigid inspection after hardening, because it was necessary to guard against changes in dimensions due to the heat-treatment. On an average, 20 per cent of the finished product was rejected by the inspectors. It was not thought possible to reduce this large proportion of scrapped work; the loss was considered unavoidable and incident to the character of the business.

A change in management brought about the introduction of many modern ideas, including the installation of a shop laboratory. All steel that enters the plant is now chemically analyzed; it is also etched for observation under the microscope. Defective steel is eliminated before any work is done on it in the shop. The results have been truly astounding, the rejections in the final inspection having been reduced from 20 per cent to less than 1 per cent. The laboratory now pays bigger dividends than any other department in the plant.

The Machine Shop Apprenticeship in Practice

Some Details of the Methods Used in the Successful Training of Machinist Apprentices at the Plant of the Falk Corporation

By C. J. FREUND, Apprentice Supervisor, The Falk Corporation

IN the article entitled "The Making of a Modern Machinist," beginning on page 801 of July MACHINERY, a complete outline was given of the methods employed by the Falk Corporation in training young men for the machine shop industry. There are a number of details in connection with this apprentice training plan that doubtless will prove of interest to those who have recently installed apprentice training systems or who are contemplating doing so.

One question that often arises is how to determine when an apprentice should be transferred from one operation or one machine to another. In some shops, this transfer is looked upon as a difficult problem. It has not been found very serious at the Falk Corporation's plant. The transfer of apprentices from one operation or machine to another is determined primarily by the training requirements, but as these requirements are easily satisfied under the plan outlined in the previous article, the apprentices can be moved about to a great extent according to the conditions of the work to be done in the various departments. It is often advantageous to utilize apprentices in departments that are shorthanded. The apprentices can be concentrated where there is the greatest pressure of work, thus giving to the organization a flexibility that would not otherwise be possible.

The Boys are Instructed by the Foremen

The necessary instruction in operating the machines is given by each foreman to the apprentices who are in his department for the time being. This instruction is not formal or in any way connected. If an apprentice is machining a gear on a boring mill, the foreman shows him how to do the work and stays with him until he understands it. In addition, he gives him such general information as the work in hand may suggest. The foreman understands that the boy is in his charge, that he is responsible for whatever he is to learn about boring mills and their operation, and his teaching is quite certain to be as complete as he can make it. Also he will give the boy as great a variety of boring mill work as circumstances will permit. The same method is followed in other departments.

Apprentices are encouraged to ask the foremen questions concerning those matters in which they require special assistance, because no foreman can know otherwise what the apprentice has learned and what he still needs to be shown. Frequently apprentices overlap on a machine, so that the one whose time on the machine is completed remains for a few days to familiarize his successor with the purely mechanical part of the machine operation.

Apprentices who display outstanding ability are given every possible opportunity for broad experience. Such boys are given unusual work when it is available, and the time thus spent is recorded as "Special Work." Some time ago a number of machines were designed and built in the shop for slotting coupling hubs. Two apprentices assisted in the assembling of these machines and were thus enabled to learn more about their construction and operation than would be possible otherwise.

A number of apprentices have been employed temporarily on repairs to machinery in the shop, especially in the case of breakdowns. Others have spent several months in the mechanical maintenance department. Recently two engines in the power plant were completely overhauled and two apprentices took part in the work.

It is customary to send apprentices for periods of three or six months at a time into smaller shops or production plants so that they will come in contact with lines of work that are not carried on in the Falk plant. In addition to giving the apprentices unusual experience, this enables those shops to carry their just share of the burden of apprentice training, in spite of the fact that their product and equipment does not justify a full apprentice training course. These special opportunities are valuable not only from a training standpoint, but also because they afford a break in the regular routine, which goes a long way toward maintaining the interest of the boys.

How Discipline is Maintained

The adjustment of problems in discipline is ordinarily divided between the foremen and the apprentice supervisors. The foreman handles each apprentice very much as he would a regular employe. Carelessness, occasional tardiness, and similar faults are corrected by the foreman. If these become flagrant, or if there is an outgrowth of playfulness or similar tendencies peculiar to the age of apprentices, the matter is referred to the apprentice department. If the apprentices as a whole develop a habit of loitering on errands, or fail to take proper care of the machines or otherwise disregard the general regulations of the plant, the matter is referred to the apprentice supervisors, and is taken up at one of the apprentice meetings mentioned in the July article.

Cases that are serious enough to raise a question as to whether or not the apprentice is to be retained are placed in the hands of the supervisors, who always attempt to get at the root of the trouble and to work out a solution that will permit the boy to continue his work. In any case, he cannot be discharged without permission from the Industrial Commission of Wisconsin after the probationary period of three months has been completed and the indenture has been signed. On the other hand, the apprentice cannot give up his work without the permission of the Commission.

Cutting Costs With a Tool Control System

A Tool Engineering and Control System that has Effected Large Savings in Manufacturing a Wide Variety of Products

By L. H. TENNEY, Tool Supervisor, De Laval Separator Co., Poughkeepsie, N. Y.

ANNUAL expenditures for small tools, jigs, fixtures, etc., have been reduced approximately $100,000 in the plant of the De Laval Separator Co. by the adoption of a tool engineering and control system. At the same time the capital tied up in small tools, which are carried in stock, has been reduced $66,000. The need for this system became evident in March, 1927, when inventories of stocked tools were increasing abnormally and had already amounted to a total investment of $100,000. Over $270,000 had been spent in 1926 for small tools, jigs, fixtures, etc.

On January 1, 1929, after eighteen months of systematic tool control under normal plant production, the value of small tools in stock was only $34,000, and the total cost of small tools, jigs, fixtures, etc., made or purchased during 1928, was only $170,000. Thus the investment in tool inventories had been reduced about 66 2/3 per cent, and the annual costs approximately 30 per cent. In addition to these economies derived from the system, the service rendered to production departments has been improved and, in many instances, tools of higher quality and great effectiveness are used. The principal features of this system will be outlined in this and a subsequent article, which will appear in September MACHINERY.

Tools Required for Making Over 7000 Parts

The products of this company are so diversified as to make the problem of tool engineering and control far more complicated than in a plant manufacturing a strictly standard line on a quantity-production basis. Over 100 standard types and sizes of separators, clarifiers, and purifiers are made and, in addition, special machines and equipments without number are produced to meet customers' problems. Altogether, over 7000 separate parts are made.

Centered Responsibility, Simplified Records, and Coordination of All Tool Activities

The important advantages of this tool engineering and control system are: First, centered responsibility; second, centralized, simplified, and more effective existing records; and third, coordination of all tool activities into a smooth-working endless chain operating without duplication of effort and having a common objective. This objective, briefly, is to supply and maintain tools economically in accordance with production requirements. In centering responsibility for the operation of a system of this kind, it is necessary to select a person who has the unreserved backing of the management and then allow him sufficient time, range, and freedom to justify this confidence.

ADVANCE TOOL LIST AND COST ESTIMATE

Part No. 10885 Name SLEEVE FOR BOWL HOIST Date 8-3-28

Op. No.	Oper. Name	Tool No.	Tool Name	Dept. No.	Est. Cost	Fin. Date	Remarks
1	Bore and Face	521325	Shank for Reamer	18	5.62	6-27-28	
		917401					
		917402	Limit Plug Gauge	18	--	-	Same as 7487
			St'd Lathe Tools	18	--	-	1 in 18.
			St'd Lathe Tools	18	--	-	-
		444701	Reamer	18	--	-	Same as 7487 1 in 18.
2	Cut Key Slot		Davis Keyseater	18	--	-	-
			(Use Standard 1/2" Cutter in Dept. 30.)				
3	Groove and Turn Outside Eccentric		S't'd. Lathe Tools	18	--	-	-
		521701	Arbor	18	5.00	7-2-28	Make 1. Locate in 18T
4	Turn Gear End	241168	Radius Tool	18	6.92	7-2-28	-
5	Drill and Ream	641653	Drill Jig	18	34.80	10-8-28	-
		421121	Drill	18	-	-	1 in 18.
		442115	Reamer	18	-	-	Same as 7754 1 in 18.
6	Inspect	--	--	2T	-	-	-
7	Cut Worm Gear	552321	Bushing	42	20.00	8-30-28	-
		721113	Hob	42	57.50	Finished	1 in 42
		521701	Arbor				Same as above
8	Inspect	--	--	2G	-	-	-
9	P.B. Stores	--	--	4H	-	-	-
				TOTAL $	129.84		

Fig. 1. Advance Tool List and Cost Estimate Devised to Facilitate the Planning and Estimating of Tools for Each Part Produced

Combined purchase of tools is another advantage of the system. Previous to the adoption of this system, the number of purchase requisitions and orders for tools placed each day ran from ten to fifteen. Several orders might be placed with the same vendor during a week or even during one day, because as soon as the drawing of a tool from stock would lower the stock to the order point, a requisition would be written for a six months' supply of that item. This requisition passed through the routine necessary to place a formal order with the concern from which the part was purchased. A few hours later another order point might be broken, and the procedure repeated, which was expensive, both from the buyer's and the vendor's standpoint.

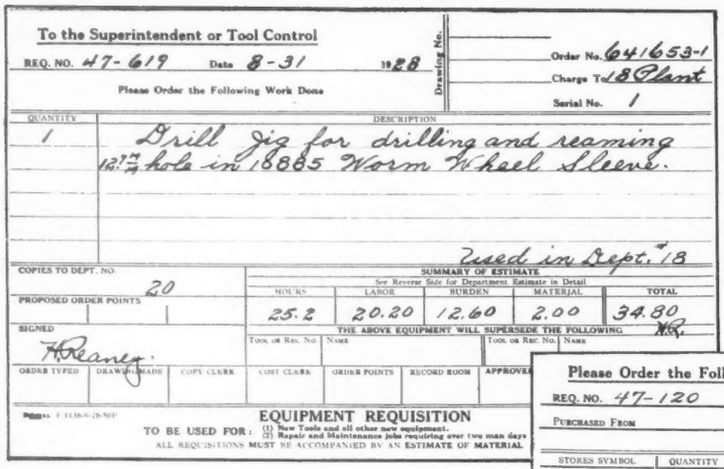
The central control has assisted materially in correcting this practice. Stocks are analyzed every three months and orders placed for a six months' supply. Every purchase requisition is scrutinized critically for possible combination of orders and for the elimination of duplications.

The system also provides the advantage of a close watch on the comparative performance of tools received from various sources, so that specifications can be made out on future orders according to the performance of tools.

Departments of Tool Division are Centralized

Headquarters of tool engineering and control were established adjacent to the product design de-

Fig. 2. Engineering Division Section of Tool Control Headquarters



To the Superintendent or Tool Control

REQ. NO. 47-619 Date 8-31 1928

Please Order the Following Work Done

Drawing No.

Order No. 641653-1

Charge To 18 Plant

Serial No. 1

QUANTITY	DESCRIPTION
1	Drill Jig for drilling and reaming 12.7/16 hole in 10885 Worm Wheel Sleeve.

Used in Dept. 18

COPIES TO DEPT. NO. 20

PROPOSED ORDER POINTS

SIGNED H. Reaney.

SUMMARY OF ESTIMATE

See Reverse Side for Department Estimate in Detail

HOURS	LABOR	BURDEN	MATERIAL	TOTAL
25.2	20.20	12.60	2.00	34.80

THE ABOVE EQUIPMENT WILL SUPERSEDE THE FOLLOWING

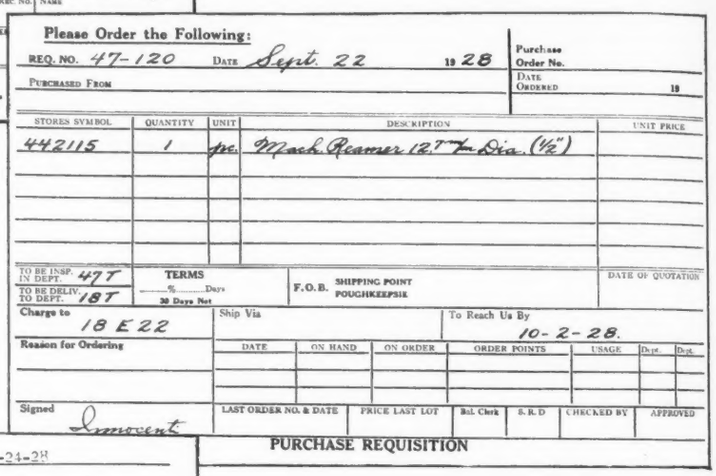
Tool or Rec. No. | Name | Tool or Rec. No. | Name

ORDER TYPED | DRAWING MADE | COPY CLERK | COST CLERK | ORDER POINTS | RECORD ROOM | APPROVED

EQUIPMENT REQUISITION

TO BE USED FOR: (1) New Tools and all other new equipment. (2) Repair and Maintenance jobs requiring over two man days

ALL REQUISITIONS MUST BE ACCOMPANIED BY AN ESTIMATE OF MATERIAL



Please Order the Following:

REQ. NO. 47-120 Date Sept. 22 1928

Purchase Order No.

Purchased From

Date Ordered 19

STORES SYMBOL	QUANTITY	UNIT	DESCRIPTION	UNIT PRICE
442115	1	pc.	Mach. Reamer 12.7 mm Dia. (½")	

TO BE INSP. IN DEPT. 47T

TO BE DELIV. TO DEPT. 18T

TERMS ____% ____Days 30 Days Net

F.O.B. SHIPPING POINT POUGHKEEPSIE

DATE OF QUOTATION

Charge to 18 E 22

Ship Via

To Reach Us By 10-2-28.

Reason for Ordering

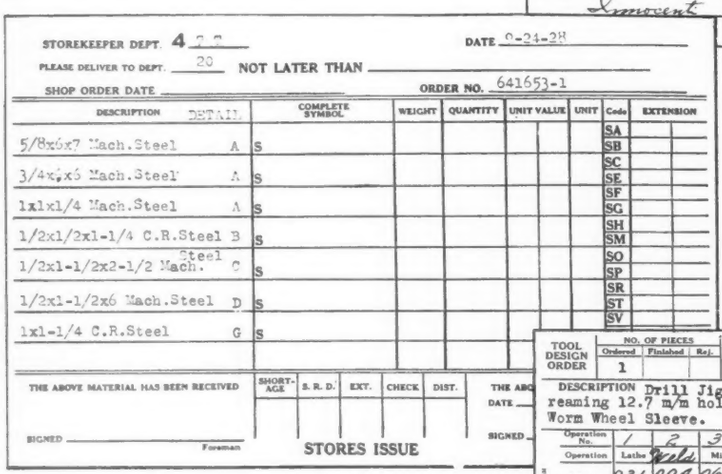
DATE	ON HAND	ON ORDER	ORDER POINTS	USAGE	Dept.	Dept.

Signed Innocent

LAST ORDER NO. & DATE | PRICE LAST LOT | Bal. Clerk | S. R. D. | CHECKED BY | APPROVED

PURCHASE REQUISITION

Fig. 3. (Above) Equipment Requisition Made out by the Engineering Division for Each New Tool to be Manufactured. Fig. 4. (At Right) Requisition Made out by the Tool Engineering Division for Each New Tool to be Purchased. Fig. 5. (Below) Form Made out for Required Raw Material as Listed on the Back of Fig. 6 by the Estimator



STOREKEEPER DEPT. 4 2 2 DATE 8-31-28

PLEASE DELIVER TO DEPT. 20 NOT LATER THAN

SHOP ORDER DATE ORDER NO. 641653-1

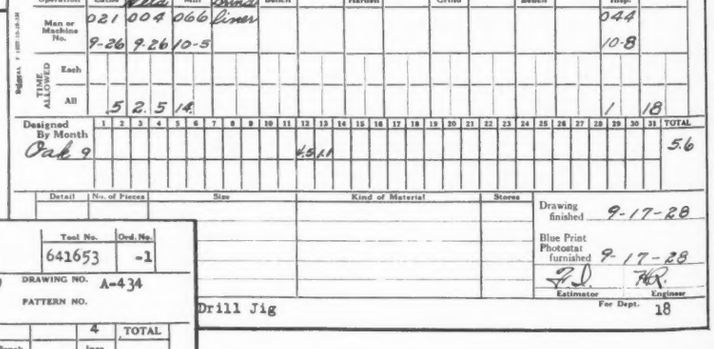
DESCRIPTION	DETAIL	COMPLETE SYMBOL	WEIGHT	QUANTITY	UNIT VALUE	UNIT	Code	EXTENSION
5/8x6x7 Mach. Steel	A	S					SA	
3/4x6x6 Mach. Steel	A	S					SB	
1x1x1/4 Mach. Steel	A	S					SC	
1/2x1/2x1-1/4 C.R.Steel	B	S					SE	
1/2x1-1/2x2-1/2 Mach. Steel	C	S					SF	
1/2x1-1/2x6 Mach. Steel	D	S					SG	
1x1-1/4 C.R.Steel	G	S					SH	
							SM	
							SO	
							SP	
							SR	
							ST	
							SV	

THE ABOVE MATERIAL HAS BEEN RECEIVED | SHORTAGE | S. R. D. | EXT. | CHECK | DIST. | THE ABOVE MATERIAL HAS BEEN ISSUED

DATE | DATE

SIGNED Foreman | SIGNED

STORES ISSUE



TOOL DESIGN ORDER | NO. OF PIECES Ordered 1 Finished | Rej. | DATE Issued 8-31-28 Due 10-8-28 Finished | Material: M.Steel and XLO Bush. (Main. only) | Tool No. 641653 | Ord. No. -1

DESCRIPTION Drill Jig for drilling and reaming 12.7 m/m hole in 10885 Worm Wheel Sleeve. REQ. NO. 47-619 DRAWING NO. A-434 PATTERN NO. SERIAL NO. 1

Operation No.	1	2	3	3	3											TOTAL
Operation	Lathe	Weld	Mill	Grind	Bench		Harden		Grind		Bench			Insp.		
Man or Machine No.	021	004	066	Liner										044		
	9-26	9-26	10-5											10-8		
TIME ALLOWED Each																
All	5	2.5	14											1	18	

Designed By Month Oak 9 | 1 2 3 4 5 6 7 8 9 10 11 12 13 14 15 16 17 18 19 20 21 22 23 24 25 26 27 28 29 30 31 TOTAL 5.6

Detail	No. of Pieces	Size	Kind of Material	Stores
Drill Jig				

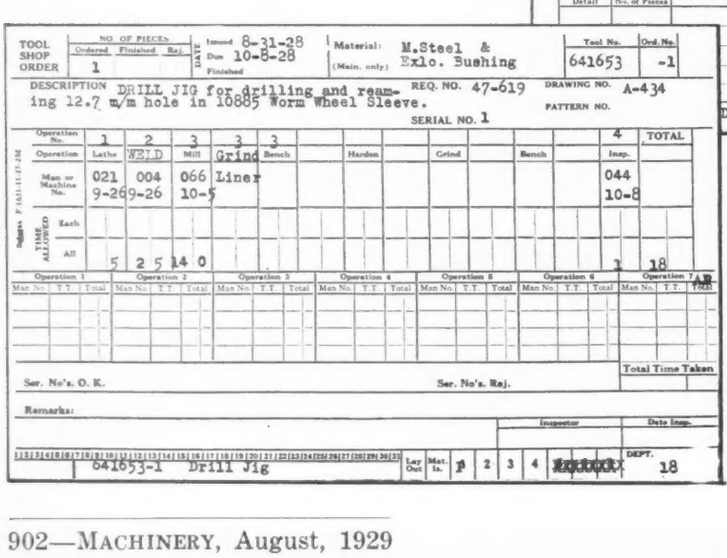
Drawing finished 9-17-28

Blue Print Photostat furnished 9-17-28

F.D. Estimator H.R. Engineer

For Dept. 18

Fig. 6. (At Right) Typical Tool Design Order which is Issued to the Engineering Division in Duplicate for All Tools to be Manufactured Fig. 7. (Below) Order Issued to Authorize Each Tool-room Operation on Any Given Job



TOOL SHOP ORDER | NO. OF PIECES Ordered 1 Finished | Rej. | DATE Issued 8-31-28 Due 10-8-28 Finished | Material: M.Steel & Exlo. Bushing (Main. only) | Tool No. 641653 | Ord. No. -1

DESCRIPTION DRILL JIG for drilling and reaming 12.7 m/m hole in 10885 Worm Wheel Sleeve. REQ. NO. 47-619 DRAWING NO. A-434 PATTERN NO. SERIAL NO. 1

Operation No.	1	2	3	3	3											4	TOTAL
Operation	Lathe	WELD	Mill	Grind	Bench		Harden		Grind		Bench					Insp.	
Man or Machine No.	021	004	066	Liner												044	
	9-26	9-26	10-5													10-8	
TIME ALLOWED Each																	
All	5	2	5	14	0											1	18

Operation 1			Operation 2			Operation 3			Operation 4			Operation 5			Operation 6			Operation 7		
Man No.	T.T.	Total	Man No.	T.T.	Total	Man No.	T.T.	Total	Man No.	T.T.	Total	Man No.	T.T.	Total	Man No.	T.T.	Total	Man No.	T.T.	Total

Total Time Taken

Ser. No's. O. K. Ser. No's. Rej.

Remarks:

Inspector Date Insp.

641653-1 Drill Jig | Lay Out | Mat. In. | 1 | 2 | 3 | 4 | DEPT. 18

partment in order that first-hand information on developments and changes in products might be quickly available to the tool division. Here, also, the tool engineering and record divisions are established adjoining each other, while the main tool-room, master tool-crib, and tool material stores are located on separate floors of the same building.

Under this tool system come all such activities as tool engineering, estimating, designing, and lay-out; scheduling of tool orders; toolmaking and servicing, including heat-treatment; specifying, receiving, and inspecting purchased tools; operation of tool store-rooms and cribs throughout the plant; specifying, inspecting, and storing of materials, including tool steels, castings, standard tool parts, etc.; and the disposition of surplus and scrapped tools.

Records of tools are maintained by a branch of the accounting department which is located in the same room as the headquarters of the tool engineering and control system. The heading illustration shows a view of the tool control headquarters from the record side, while Fig. 2 shows it from the engineering side.

Activities of the Tool Engineering Division

The tool engineering division is responsible, first, for laying out and estimating tools and, second, for routing the tools to the shop in accordance with production demands. Floor and plant lay-outs are also frequently made by this division, the purchase of new machine tools recommended, and special machines designed.

The tool engineering division receives a blueprint from the product design department for every new part to be produced. These parts are considered carefully in the tool engineering department and the demand estimated, since the probable demand has a great bearing on the manufacturing method to be used. The variety and number of special units made does not permit of tooling every job for quantity production, yet tool lay-outs are necessary for the sake of economy and interchangeability.

To facilitate the work of laying out and estimating tools, the standard form "Advance Tool List and Cost Estimate" shown in Fig. 1 was devised. On this form can be recorded methods and equipment agreed upon by those concerned as meeting all requirements for the produc-

STOREKEEPER DEPT. 47T — DATE 10-10-28

PLEASE DELIVER TO DEPT. 18 — NOT LATER THAN 10-10-28 — CHARGE TO 18C22

THIS SPACE FOR SHOP

The Following Tools in Replacement for Scrap Returned

QUANTITY & CAUSE FOR SCRAPPING: Worn Out	Broken	Obsolete	DESCRIPTION	TOOL NO.	QUANTITY: Ord'd.	New	Recl.	UNIT VALUE
1			Drill T. S. H.S. 31/64	4211 21	1	1		90
OTHER CAUSE		TOOL NO.						
		4/2121	The Above Has Been Received — Foreman	Scrap Rec'd. and Above has been Issued — Storekeeper				

RECLAIMING

The Following Disposition has been made of above scrap. — Date

JUNKED	RECL. INTO TOOL NO.	TIME TAKEN	CREDIT ORDER	INSPECTED	DELIVERED TO Dept. No.	DELIVERED TO Stores	SIGNED
						47T	
						47T	

Above Recl. Tool Rec'd. In Dept. _____ Charge to _____ Foreman — Rec'd. in Stores _____ Storekeeper

TOOL CONTROL

PLANT TOOLS: Total Net Value	Credit	Charge	RECLAIMED TOOLS: Unit Value	Extension	BAL. CARD: Issue	Scrap	Est.	Check	Dist.	Code	Extension
					B	B	L	M	R	ST	90

Bal Card | F. 1625 | F. 1633 | F. 1635 | DIST. — Bal. Card | Est. | Check | Dist.

Send Original and Duplicate with Scrap to Dept. 47T, Original to Tool Control when Replacement Tool is issued, Duplicate to Tool Control When Scrapped is Disposed of.

TOOL REPLACEMENT ISSUE AND SCRAP TICKET

The Same Quantity of Scrapped Tools MUST be Returned in Exchange for New or Reclaimed.

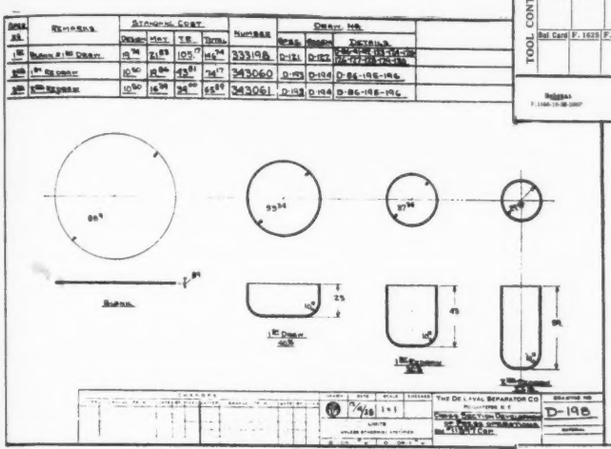


Fig. 8. (Above) Form on which Tools are Ordered from the Storekeeper for Replacement Purposes. Fig. 9. (At Left) Data Sheet of the Type Made up in Loose-leaf Form to Save the Time of Designers. Fig. 10. (Below) Master Tool List of All Tools Required for a Given Part, Retained in the Record Division

PART NO. 10885 — TOOL LIST — PART NAME Sleeve

PATTERN NO. — DRAWING NO. C-1165

Routing Date 4-26-28 — Change in Routing 7/6/28

Line No.	Tool No.	Op.	Dept.	Line No.	Tool No.	Op.	Dept.	Line No.	Tool No.	Op.	Dept.	Line No.	Tool No.	Op.	Dept.	Line No.	Tool No.	Op.	Dept.
1	534325	1	18	16				31				46				61			
2	917401	1	18	17				32				47				62			
3	917402	1	18	18				33				48				63			
4	446701	1	18	19				34				49				64			
5	521701	3	18	20				35				50				65			
6	241168	4	18	21				36				51				66			
7	641653	5	18	22				37				52				67			
8	421121	5	18	23				38				53				68			
9	442115	5	18	24				39				54				69			
10	552324	7	42	25				40				55				70			
11	721113	7	42	26				41				56				71			
	721701	7	42	27				42				57				72			
				28				43				58				73			
				29				44				59				74			
				30				45				60				75			

NO. 10885 NAME Sleeve — FOR MACHINE NO. 600-601-700-701-900-901

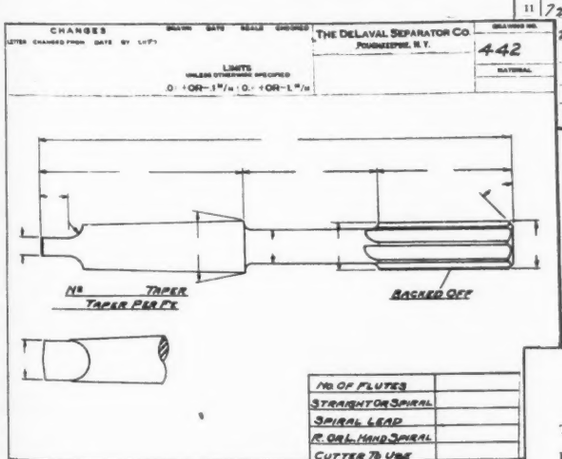


Fig. 11. (At Left) Standardized Drawing Typical of Many that are Made up Ready for Use by Merely Filling in Certain Dimensions. Fig. 12. (Below) Simple Form on which Data Relative to Suggested Tooling Changes can be Conveniently Itemized

FACTORY MEMORANDUM

To Mr. — Date, 12-18-28

Dep't No. — SUBJECT TOOL CONSIDERATION

Investigation as to advisability of Drill Jig for 9768

1927 USAGE 143 — 1928 USAGE 190 — 1929 USAGE

ORDER #	TOTAL NO. PIECES	TOTAL MAT. COST	TOTAL NO. OF HOURS	TOTAL LABOR	TOTAL BURDEN	TOTAL	UNIT COST
-11	50	17.99	20.	11.34	23.15	53.08	1.06
-12	50	14.51	15.2	9.53	17.46	41.50	.83

		UNIT: HOURS	LABOR	BURDEN	COST	COST OF YEAR PRODUCTION
Operation Performed drilling	Present	.056	.0292	.0872	.1174	22.11
	Estimated	.036	.0187	.0558	.0745	14.15
						7.96

Est. saving by use of New Tool

Est. Cost of drill jig $60.00

Material per Estimator

Detail	No. of Pieces	Size	Kind of Material	Stores
A	1	5/8 x 6 x 7	Mach. Steel	47T
"	2	3/4 x 6 x 6	" "	"
"	4	1 x 1 x 1/4	" "	"
B	1	1/2 x 1/2 x 1 1/4	C. R. Steel	"
C	1	1/2 x 1 1/2 x 2 1/2	Mach. Steel	"
D	1	1/2 x 1 1/2 x 6	Mach. Steel	"
G	1	1 x 1 1/4	C. R. Steel	"
H	1	1/2 x 9 1/4	C. R. Steel	"
M	1	x3-for 31/64 Drill	XLO Bush.	"
N	1	X 53	XLO Liner	"
O	1	#1	XLO Screw	4R

Fig. 13. Raw Material List Written in on Back of Form Shown in Fig. 6 by the Lay-out Clerk

tion set-up of a part in question. Estimated costs of new equipment required and delivery dates of such equipment can also be itemized.

Such a list is made up for every part to be put in production. It is often possible to list tools already in stock, and slight changes in the design of the product are frequently recommended by the tool engineers to simplify the tooling. Such changes should obviously be suggested when first planning the manufacture of a product, rather than after several parts have gone to the manufacturer. It may then be too late to make desirable changes, especially when parts are worked on in different departments which have no knowledge of the final assembly methods.

Each production department foreman is consulted in making up the advance tool list and cost estimate. After the estimates have been made, they must be approved by the tool supervisor and the shop superintendent. Copies are then sent to the tool-room, to each production foreman, and to the shop planning department, which serve as a guide in scheduling the work of these departments. The production foreman examines his copy and turns it over to the lay-out clerk, who, in turn, passes it to the proper crib attendant as a notice of tools coming and of the tools to be required for each operation on the part in question. The advance tool list thus relieves the production foreman from searching for suitable tools, and enables operators to go to the tool-crib and quickly get all the tools required. There is the added advantage of a record in the tool-crib of all tools used on each part.

DATE 12-10-28 STOREROOM 47T
SYMBOL S 421121
NAME Drill, T.S.-H.S.
31/64" (12.302 m/m)

ORDER POINT	AMT. TO ORDER	TIME FOR DELIVERY	UNIT
3	12	4 weeks.	

F.1206-5-28-5M BIN LABEL (COMMERCIAL) Printed in U.S.A.

Fig. 14. Label Attached to the Bins of Tool-cribs to Identify the Tools

Requisitions for Stock Materials and Tools to be Made or Purchased

Immediately after an advance tool list and cost estimate has been issued, equipment requisitions are made out by the engineering division on the form illustrated in Fig. 3 for each new tool to be manufactured, while a purchase requisition such as shown in Fig. 4, is issued for each new tool to be purchased. Numbers are assigned for all requisitions and orders issued by the record division, requisitions for tools or materials to be bought being sent to the purchasing department. However, before tools can be ordered, each requisition is investigated as to the application of the tool and the possibility of its duplicating or superseding tools existing in stock.

Two tool design orders made out on the form shown in Fig. 6 are issued to the engineering division for tools to be manufactured. One of these design orders is filed in a visible Kardex panel in the tool engineering division, while the other is filed according to the number of the designer who is to do the work and in the desired sequence. When an engineer commences the design, the second copy is placed in a special holder on his drafting board, where it is visible to the head of the department and the time clerk while the design is in progress. The designer posts his own time on this form in agreement with the time turned in on his time card.

TOOL NO. 641653 | NAME Drill Jig | DEPT. NO 18

DESCRIPTION For drilling and reaming 12.7 m/m hole in Worm Wheel Sleeve.

First Order Started	Date Due	Charge
9-24-28	10-8	18 Keokuk Plant
Date	Order Points	Max. Bal. All'd.
8-31-28	— —	1

Drawing No. A-434 Pattern No.

For Part No.	Oper. No.	In De Laval No.	Location	Remarks
10885				

Printed in U.S.A.

Supersedes

TOOL LOCATION CARD

Tool No.	Name	Dept.	Requisit. Req.	Change Notice No.
641653	Drill Jig	18	47-619	

Fig. 15. Tool Location Card Filled in by the Record Division whenever a Manufacturing Order or a Purchase Requisition is Made out

When designs and detail drawings are completed and checked, prints are made and attached to both copies of the design order and then passed to the lay-out clerk. This clerk lists manufacturing operations on one copy, together with the time estimates, and specifies the finish dates. He lists the required material on the back of the same form, as shown in Fig. 13. Material not in stock is ordered on the purchase requisition shown in Fig. 4.

Both design orders with the blueprints attached are next passed to the record division, where two

duplicate forms, such as shown in Fig. 5, are typed for the necessary stock material. One of these copies goes to the tool material stores on the first floor of the same building, and the other copy is sent to the tool-room on the second floor with copies of a manufacturing order, such as shown in Fig. 7, the latter form being only slightly different from that shown in Fig. 6.

When the order shown in Fig. 5 reaches the material store-room, the required material is cut to specifications and sent by a dumbwaiter to the receiving bench of the tool-room, directly above the store-room. The original issue is then signed and returned to the record division, where it is placed in a closed-order folder, while the duplicate slip remains with the material to serve as a means of identification.

PART Sleeve NO. 10885 OPERATION Bore & Face NO. 1
DWG. NO. C-1165 DEPT. NO. 18 MACH. SIZE

PIECES ON HAND	NAME	PCS. USED	SIZE	SYMBOL	LOCATION
	Reamer		74.14m/m	444701	
	Arbor		38.0 m/m	521325	
	Plug Gauge		74.14m/m	917401	
	Plug Gauge		74.18m/m	917402	

When the tool list is not correct, please report the error at once to the Tool Control. DATE 8-31-28 SIGNED
TOOLS CALLED FOR ON THIS LIST MUST BE ISSUED TOGETHER
Diagram F.1135-10-25-1927 **TOOL LIST** Printed in U.S.A.

Fig. 17. Permanent Tool List Filed in the Tool-crib of the Production Department in which the Part is to be Manufactured

Tool Location Cards and Bin Labels Facilitate the Operation of Tool-cribs

Whenever a manufacturing order or a purchase requisition for a new tool is issued, the record division sends a location card, such as shown in Fig. 15, and a bin label, made out as illustrated in Fig. 14, to the crib attendant in the department where the tool is to be used. The location card notifies the department that the order for the tool covered by the card has been placed, and tells the crib attendant when it should be delivered. It is placed by the crib attendant in a tickler file, where it remains until the tool is received, after which the card is filed according to the tool number to indicate the location of the tool. A master location and depreciation card, such as shown in Fig. 16, is kept in the record division for every tool.

TOOL NO. 641653 — Drill Jig — DEPT. NO. 18

DESCRIPTION For drilling and reaming 12.7 m/m hole in Worm Wheel Sleeve.

First Order Started	Date Due	Charge Plant
9-24-28	10-8	18
Date	**Order Points**	**Max. Bal. All'd.**
8-31-28	— —	1

Drawing No. A-434 Pattern No.

For Part No.	Oper. No.	In De Laval No.	Location	Ser. No.	Total Cost	Value of Inventory Dec. 31st. 19	19	19	19	19
10885										

Date	Scrap	Obsolete	Superseded	Ref.

Supersedes

TOOL DEPRECIATION CARD

Tool No.	Name	Dept.	Equipt. Req.	Change Notice No.
641653	Drill Jig	18	47-619	

Diagram F.1933 Printed in U.S.A.

Fig. 16. Master Location and Depreciation Card Kept in the Record Division for Every Tool in the Shop

The bin label, Fig. 14, is attached to the bin of the tool-crib in which the tool is to be kept. The label carries information as to the minimum amount of tools that should be carried in stock, the amount of tools to be ordered at a time, and the time required for delivery. The crib attendant is responsible for requisitions to replace tools as the quantity falls below the order point. If he fails to do so, he will be notified by the record division through the crib supervisor. This is made certain by the use of the tool replacement issue and scrap ticket shown in Fig. 8.

As each new tool is received by the tool-crib of a manufacturing department, it is checked on the advance tool list, Fig. 1, and, incidentally, as soon as the complete list of tools for each succeeding operation on a part is received, the foreman is notified. When the complete list of tools has been received by the production division and the first order of parts has been run through, the advance list is signed by the production foreman, the crib attendant, and the crib supervisor, and then returned to the tool engineering division with pertinent comments. These comments are investigated, after which the tool list is finally approved by the tool supervisor and passed to the record division. Here a permanent tool list is made out on the form shown in Fig. 17 and forwarded to the crib attendant, while a master list is made up on the form in Fig. 10 and kept in the record division.

Standard Practices of the Tool Engineering Division

For parts that are to be manufactured in small quantities, simple lay-out templets are ordered whenever they are deemed practical. Many

MACHINE TOOL DATA

Name Milling Mach. Size No. 3 D-No. 547
Maker Cinn. Milling Mach. Co.
Purch. From Cinn. Milling Mach. Co.
Date Ordered 4-5-23 Req. No. 54C644 P.O. No. 31748 Date Rec'd 6/20/23
Cost $3475.00 LOCATION-DEPT. 9
Capacity
Base Dimensions 57" X 29" Weight 6000 LBS.
Work Table Dim. 7'6" x 4' T-slots 5/8" x 2 5/8 Centers
Swivel 52° Rev. & Traverse 34" Cross-Travel 10"
No Speeds 16 R.P.M. 1st 2nd 3rd
4th 5th 6th 7th 8th
No Feeds 16 Fd. per Rev. .007 to .300

For Further Detail See Data Sheet No.....

Fig. 18. Card Used for Recording Data Concerning All Machine Tools in the Plant

jigs and fixtures are designed to be built up from sheet steel and arc-welded together, as it has been found that this method is not only economical, but also saves time lost in waiting for the patterns required when castings are necessary. To save the designers' time, drawings of tools that can be used on similar jobs are printed on Velox paper, the dimensions that affect the part being left blank, as illustrated in Fig. 11. A quantity of these printed sheets is kept on hand for each tool, so that whenever a tool is required it is simply necessary to fill in certain dimensions.

Standard tool parts, such as jig bushings, die sets, etc., are stocked ready for immediate use. Some tools are semi-finished and placed in stock. Surfaces of such tools that fit a machine or part are finished except for any grinding required for accuracy, while surfaces for which the dimensions are not established until the tool is actually required are left over-size and finished to suit when needed. Examples of this classification include spring collets, guide pins, plug gage handles, tap blanks, die blanks, rubber-mold blanks, etc.

Data sheets relating to all machine tools in the plant are compiled and filed so as to be available to the tool designers and production foremen, and repair men are warned not to alter machine tools without notifying the tool engineering division. This data concerning machine tools saves a great deal of expensive designing time. A typical data sheet is seen in Fig. 18. Data on sheet-steel forming and drawing operations is made up on loose-leaf forms, as illustrated in Fig. 9, so as to save time in laying out dies.

Modern Methods Insured by the Use of Engineering Periodicals

Engineering and tool design data is stripped from current periodicals, such as MACHINERY, classified as to the subject matter, and bound for ready reference. It has been the writer's experience that although available handbooks carry a large fund of valuable formulas and information, it is also important to keep in touch with up-to-the-minute developments. Periodicals are the best means for doing this, but it is not enough for a busy executive to glance through them. It is advisable and proper to assign someone to the task of classifying and binding important articles in loose-leaf form and then placing them before the men responsible for each class of work.

Each member of the tool control staff is asked to make suggestions concerning changes in operating methods or improved tooling that will save time and money. Suggestions also often come from production foremen and the time study division. All suggestions are considered carefully, the cost of operation by the proposed method being compared with the old, and the period required to effect a saving equal to the cost of the change recommended being carefully determined. The estimates are then itemized on the form reproduced in Fig. 12.

Tool engineers are instructed to proceed with any change of tooling on a stable part that will pay for itself in one year. When longer periods are required, special consideration must be given. Many changes that are made pay for themselves in a few months. Some of these changes have been made practical by increased demand for a product, and others by progress in tool engineering generally. Constant checking up on the performance of tools with a view to selecting the best steels or alloys for the materials machined by them is another important activity of the tool engineering division.

In a second article, to be published in September MACHINERY, the writer will deal with the activities of the tool-manufacturing, tool-crib, and tool-record divisions.

Die Clearance for Aluminum

There has been very little published on the correct clearances to be used for dies for shearing and blanking aluminum. The results obtained in blanking steel with dies having varying amounts of clearance were described in May, 1927, MACHINERY. Aluminum, however, acts quite differently from steel, and frequently, when shearing, punching, or blanking this metal, a rough surface is obtained on the sheared edges. The leading article to appear in September MACHINERY "Die Clearances for Blanking Aluminum," will prove of especial value as an original contribution to engineering literature. It gives the results of laboratory tests conducted especially for the purpose of determining the correct die clearances for blanking aluminum and aluminum alloy sheets.

* * *

EARLY DAYS OF RAILWAYS

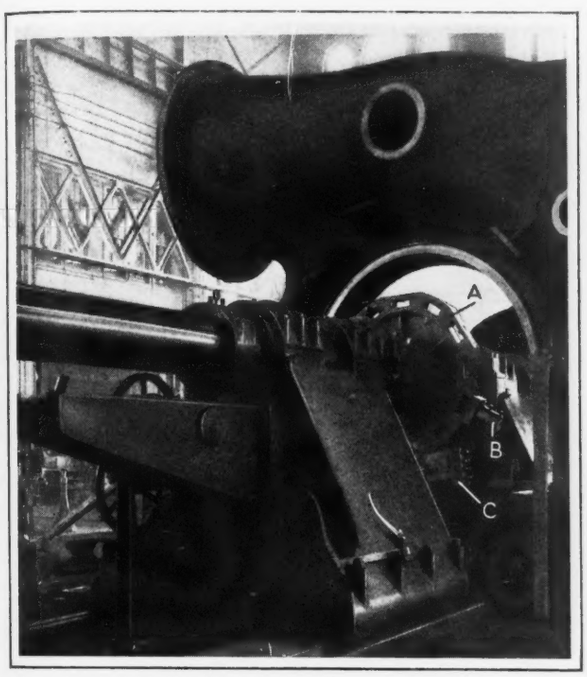
Usually we think of the beginning of railways as coincident with the development of the locomotive in the early years of the past century. It is pointed out in *Engineering*, however, that railroads were in use long before locomotives, and that their history carries us back as far as the fifteenth century, when longitudinal timbers were laid on roads in mining districts and acted as rails for cars on which coal and ore were transported. As long ago as 1676, Roger North refers to railroads in the neighborhood of Newcastle and points out that the ownership of the right of way had already at that time created a serious problem of monopoly.

He further states that the manner of transportation "is by laying rails of timber from the colliery down to the river exactly straight and parallel; and bulky carts are made with four rowlets fitting these rails, whereby the carriage is so easy that one horse will draw down four or five chaldron of coal, and is an immense benefit to the coal merchants."

One of these railways, constructed between 1712 and 1725 near Newcastle, was five miles long and involved embarkments and a masonry arch of 102-foot span. The use of cast-iron rails began toward the end of the eighteenth century, and a public railway to connect London and Portsmouth was promoted in 1799 and completed as far as Croyden in 1803, and as far as Merstham in 1805. This road was known as the Surrey Iron Railway, and is said to have been the first railway sanctioned by an Act of Parliament. At that time there was no intention of operating this railway by steam power, as the locomotive had not yet been developed. With its arrival, the railroad became of age.

A BORING HEAD THAT FINISHES SEVERAL SURFACES AT ONE TIME

Large steam engine cylinders, water turbine casings, and similar parts are bored and faced at the plant of the Hooven, Owens, Rentschler Co., Hamilton, Ohio, in the big horizontal boring mill shown in the accompanying illustration. One-half of a water turbine casing is shown at the end of an operation in which the casing was bored and faced at the center to receive the rotor. In the



Boring and Facing a Turbine Casing to Receive the Rotor

assembly of the turbine, this casing rests on another part similarly bored. The diameter of the bore is approximately 6 feet. Considerable blocking up of the work on the boring machine table was required in order to bring the rough-cast hole central with the boring spindle.

Boring and facing cuts are taken in this machine by means of tools held in fixtures attached to the twelve-sided head *A* which is mounted on the boring-bar. By providing various tools in different types of fixtures, boring or facing cuts can be taken simultaneously on several surfaces, but, obviously, both types of cuts cannot be taken at the same time. A typical boring tool holder is shown at *B*, and a facing head at *C*.

The facing heads are fed radially at each revolution past the work, while the boring tools are adjusted after each longitudinal movement over the surfaces being bored. The bar on which tool-head *A* is mounted is 14 inches in diameter, and is supported on both sides of the tool-head.

* * *

A new cable laid by the Western Union Telegraph Co. between Newfoundland and the Azores permits the sending of as many as eight separate messages —four incoming and four outgoing—over the line at one time. It is stated that these results are largely due to the fact that the wrapping wire and the core of the cable are made from a new alloy known as "Mumetal."

PORTABLE ELECTRIC TOOLS IN AN AUTOMOBILE PLANT

In July MACHINERY, page 824, numerous applications of portable tools in a truck manufacturing plant were illustrated. The present article shows the use of similar tools in one of the largest automobile plants in the country, where cars of several different sizes and models are built. The portable tools shown in this article, made by the Independent Pneumatic Tool Co., Chicago, Ill., are all electrically driven.

In Fig. 1 is shown a high-frequency electric nut-setter used in attaching the flywheel to the crankshaft by means of cap-screws. Fig. 2 shows a similar nut-setter, but of a much heavier type and provided with a heavy-duty malleable gear-case, engaged in driving the main bearing nuts. This equipment runs at 710 revolutions per minute. The entire portable outfit weighs 34 pounds.

Figs. 3 and 4 show additional applications of nut-setters. Fig. 3 shows how 7/16-inch rear body bolts are driven from a pit beneath the car. The tool used weighs only 9 pounds. It runs at a speed of 680 revolutions per minute. In Fig. 4 connecting-rod nuts are being backed off. This nut-setter is provided with a positive clutch and reverse winding. It is a heavier type than the one shown in Fig. 3, weighing slightly over 24 pounds.

In Fig. 5 two portable tools are employed. The one at the left is used for countersinking oil-holes in the main bearing caps, while the one at the right is used for driving 1/4-inch cap-screws in the rear main bearing oil retainers. In Fig. 6 the same type of heavy nut-setter shown in Fig. 2 is used for tightening the cylinder head nuts.

Fig. 7 shows an electric nut-setter mounted in and supported by a portable stand to facilitate the

Fig. 1. Electric Nut-setter Used for Attaching the Flywheel to the Crankshaft of an Automobile

work of the operator. In this case, the tool is used for backing off main bearing nuts. In Fig. 8, the portable nut-setter is used for driving steering-gear bolt nuts, and in Fig. 9, for driving connecting-rod nuts.

The electric drill shown in Fig. 10 is used, not for drilling, but for driving manifold studs at a speed of 1075 revolutions per minute. In Fig. 11

Fig. 2. Electric Nut-setter with Heavy-duty Gear-case Driving Main Bearing Nuts in an Automobile Crankcase

Fig. 3. (Left) Driving Rear Body Bolts from a Pit Below. Fig. 4. (Above) Backing off Connecting-rod Nuts with Electric Nut-setter

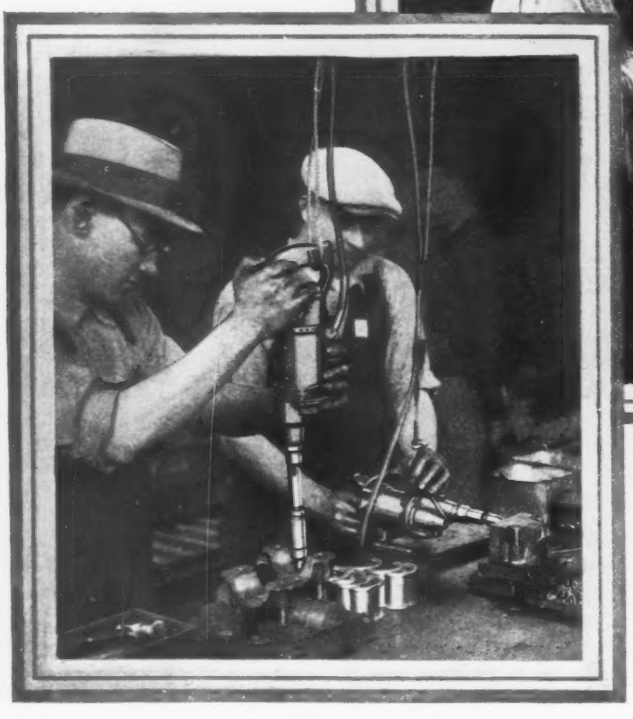


Fig. 5. Countersinking Oil-holes in Main Bearing Caps, and Driving Cap-screws in Oil Retainer

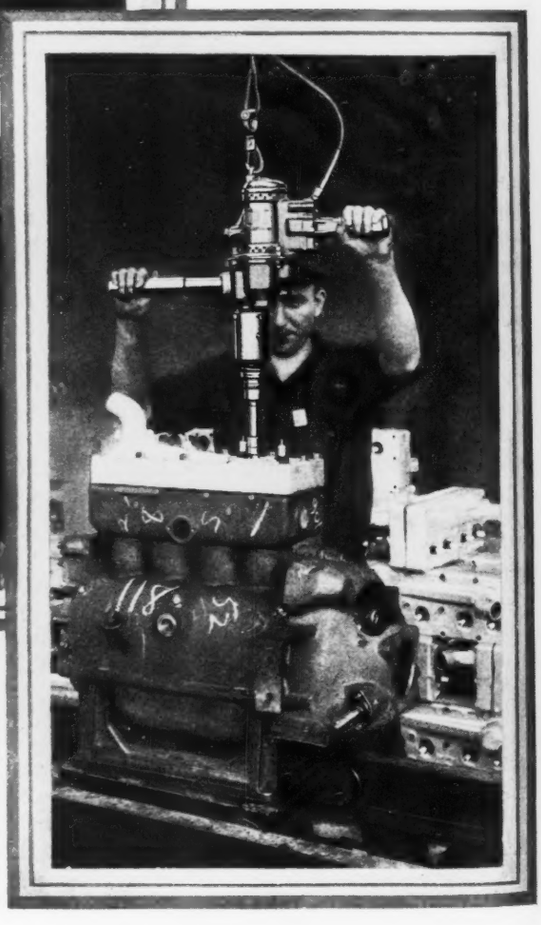


Fig. 6. Heavy Type of Nut-setter Being Used for Tightening Cylinder Head Nuts

Fig. 7. Heavy Type of Electric Nut-setter, with Bracket for Mounting in a Portable Stand, Used for Backing off Main Bearing Nuts

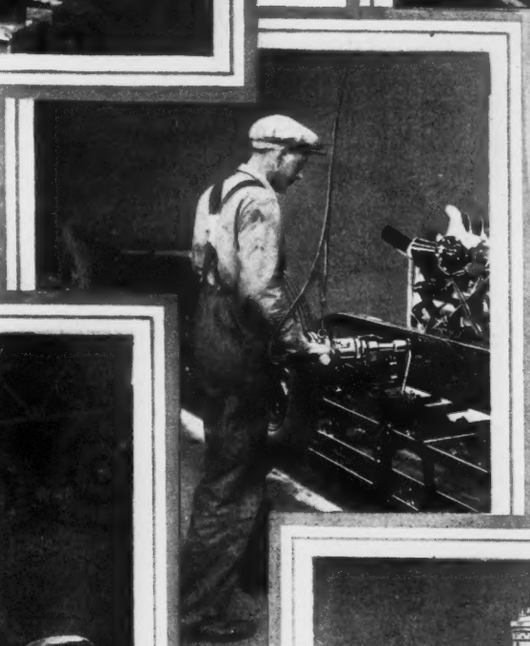


Fig. 8. (Left) Driving Auto Steering-gear Bolt Nuts. Fig. 9. (Above) Driving the Connecting-rod Nuts

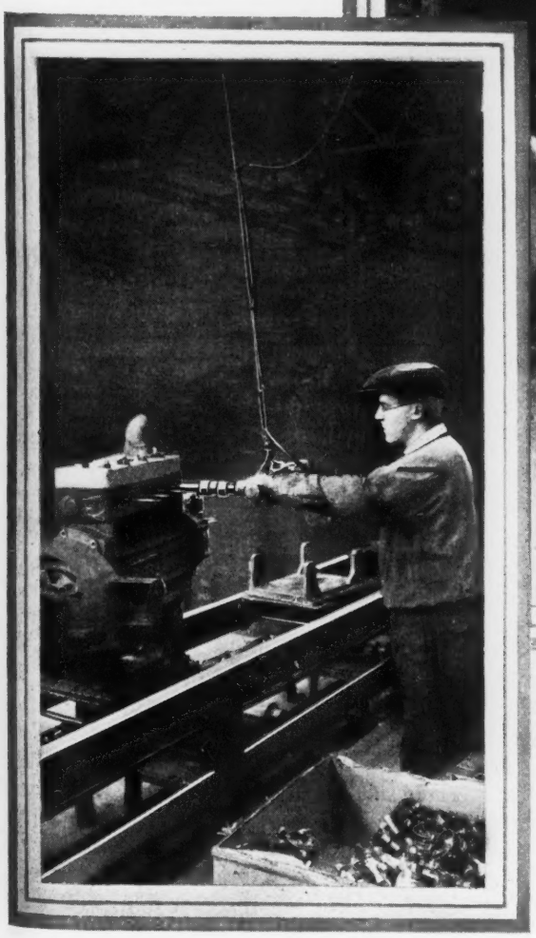


Fig. 10. Electric Drill Equipped with Collapsible Stud Driver, Used for Driving Manifold Studs

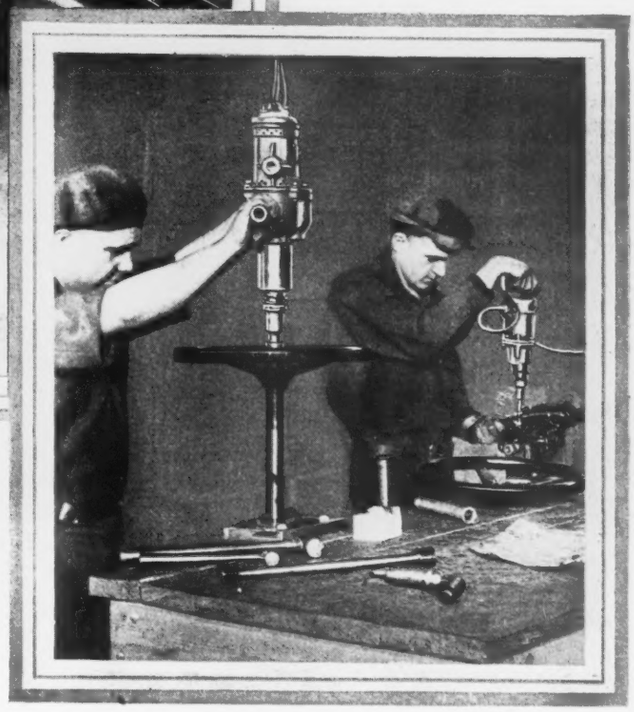


Fig. 11. Driving Steering-wheel Nuts, and Tightening Screws in Lower End of Gas Control

the nut-setter at the left is used for driving steering-wheel nuts, and the electric screwdriver shown in operation at the right is employed for driving screws in the lower end of the gas control. These numerous examples show the great variety of work for which portable tools of this kind may be used to advantage in an automobile plant, and indicate the extensive application these tools have in work of this kind.

* * *

A NEW ENGLISH CUTTING METAL

A series of tests, to show the possibilities of a new cutting metal known as S.O.B.V. cutting alloy, has been carried out by the makers of the alloy, Samuel Osborn & Co., Ltd., Sheffield, England. A shaft containing 0.28 per cent carbon and 0.60 per cent manganese steel, and having a tensile strength of 60,000 pounds per square inch, with a Brinell hardness of 131, was used for this purpose. The tests were performed on a lathe driven by a 40-horsepower motor.

Steel Cut at 280 Feet Surface Speed per Minute

Using a one-inch square tool, with the shaft revolving at a speed of 280 feet per minute and a feed of 1/30 inch, a cut 3/16 inch deep was taken. The speed was increased by 10 feet every 15 seconds, the tool cutting satisfactorily until 370 feet per minute was reached. The test was repeated, using the other end of the tool, with practically the same results.

Low Speed and Coarse Feed Test

In another test, a 2- by 1 1/2-inch round-nose roughing tool was used, with a cutting speed of 80 feet per minute, the depth of cut being 13/16 inch and the feed 1/8 inch. After 15 seconds, the motor stalled, but the tool was found to be in good condition. The cut was then altered to 9/16 inch, with a feed of 1/8 inch. After 30 seconds of turning, the tool came up to a shoulder in the test shaft, which increased the cut to 1 inch deep. The motor again stalled, the tool remaining in good condition. The cut was then changed to 3/4 inch deep, with a feed of 1/12 inch. The tool, cutting for 12 minutes to the end of the shaft, was next moved back to the other end, 30 seconds being consumed in doing this, after which the tool continued cutting for another 7 minutes.

The total time, on the 3/4-inch cut was 19 minutes, distance traversed 33 inches on a diameter of 11 3/16 inches, plus 15 inches on a diameter of 9 11/16 inches, or a total distance of 4 feet. The weight of metal removed was 328 pounds in 19 minutes, or at the rate of 17.2 pounds per minute. While the tool was cutting, the nose was red hot for 1/4 inch in depth.

Removing Metal at the Rate of 1320 Pounds per Hour

The object of the next test was to determine the largest cut and the greatest feed which the lathe would stand. A 2- by 1 1/2-inch square-nosed roughing tool was used, cutting at a speed of 26 feet per minute, to a depth of 1 inch, with a feed of 1/4 inch. In order to get the necessary depth of cut, the tool was fed into the shaft, and after cutting at the full depth for a short time, the motor stalled. The cutting edge of the tool was unharmed, and during this test the amount of material removed was at the rate of 1320 pounds per hour. In all the tests mentioned, all cutting was done without lubricant.

Other Remarkable Results Obtained

In still another test a shaft was turned with a 2- by 1 1/2-inch tool at speeds of 102, 111, and 129 feet per minute, the depth of cut being 5/8 inch, and the feed 1/32 inch. In this case a cutting lubricant was employed. The tool cut for 1 1/2 hours without grinding, half of this time at the highest speed.

On a steel shaft having a tensile strength of approximately 65,000 pounds per square inch, a 1 1/4-inch square tool took a cut 1 inch deep, with 1/16 inch feed, at 85 feet per minute, but after traversing 5 inches, the lathe proved incapable of finishing the cut. In another case, a shaft of similar material was turned at 304 feet per minute, taking a cut 3/16 inch deep, with 1/32 inch feed. After traversing 22 inches, the tool, which was 1 1/2 inches square, was touched up on the grindstone and put back to work at 314 feet per minute, with a cut 3/16 inch deep, and a feed of 1/32 inch. At this speed the tool traversed 18 3/4 inches to the end of the shaft and was still in good condition.

A steel ram for a hydraulic press, 2 feet long, of nickel-chrome air-hardened steel, heat-treated and having a tensile strength of 220,000 pounds per square inch, was rough-turned at 21 feet per minute with three tool grinds. The depth of cut was 1/32 inch, and the feed 1/70 inch. The finishing cut was taken at the same speed without regrinding the tool, all the cutting being done dry.

On railway wheels and tires, the following figures are of interest. In one case, six pairs of wheels were turned without the tool being reground and the tool was in good condition at the end of the operation. In another instance, a button tool turned thirty-two brake-hardened tires without regrinding. One user states that the S.O.B.V. tire tools are averaging over 100 tires for each grinding of the tools.

* * *

ADVANTAGES OF ALUMINUM PAINT

According to a bulletin issued by the Bureau of Construction and Repair of the Navy Department, aluminum paint has been used instead of red lead for many purposes by the Navy. It has been found, however, that the paint should not be employed where it is exposed to water for long periods, as it tends to soften and blister when submerged for a long time in either salt or fresh water. Furthermore, aluminum paint does not withstand the action of petroleum, and is not suitable, therefore, for painting the interior of fuel oil tanks. The advantages of aluminum paint, as compared with red lead, are light weight, improved appearance, and better lighting effect in interiors painted with aluminum paint. It is also a more agreeable material to work with and the painting is more easily inspected.

Time-saving Double-spindle Burring Machine

Construction of Opposed Double-spindle Machine Used in Removing the Burrs from Both Sides of Small Drilled Parts

By R. E. McCOY

THE machine described in this article was built for the purpose of removing the burrs from the drilled or punched holes in small interchangeable parts like those shown in Fig. 1. For this class of work it is necessary to remove the burrs from both sides of the parts. This was formerly accomplished by pressing one side of the work against the point of the rapidly revolving drill, and then turning it over in the hand and burring the opposite side in a similar manner. The drill, in this case, was held in a chuck mounted on a horizontal spindle with grooved pulleys, as shown in Fig. 4.

The collar *C* which controlled the depth or amount of burr to be removed was secured to the drill by a headless setscrew. The improved burring machine which replaced the older type is shown in Fig. 2. This machine is of the bench type, and has two spindles equipped with chucks *A* and *B*, which are in accurate alignment and which revolve in opposite directions. The spindles are mounted in the brackets *C* and *D* which, in turn, are fastened to the base *E* by fillister-head screws.

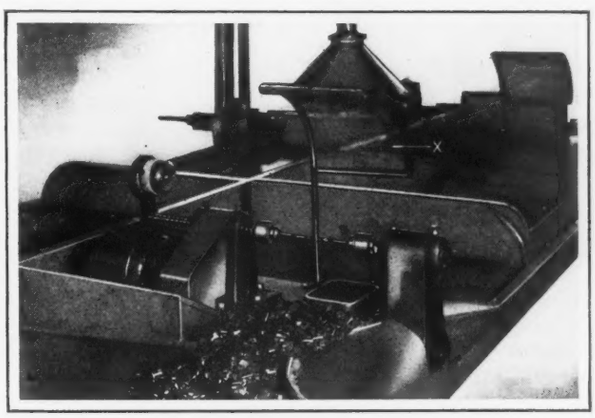


Fig. 1. Machine for Burring Both Sides of a Part Simultaneously

A 1/20-horsepower motor, mounted on the base as shown, serves to drive the spindles by means of two 3/8-inch pitch chains which pass over the sprockets *F*, *G*, and *H* at one end and *I* and *J* at the other end. An end view of the motor drive is shown in Fig. 3. A chain drive is preferable in this case, owing to the short center distance between the shafts. The idler sprocket *H*, which revolves on stud *K*, Fig. 2, is keyed to gear *L*. Gear *L*, in turn, meshes with the gear *M* mounted on shaft *N*, which extends through the front of the base. The driving sprocket *I* is secured to shaft *N* on the outside of the base, as illustrated, and serves to drive the front spindle *R*.

A key *O*, having ends that project upward in slots at the ends of the hub of sprocket *G*, drives the spindle *R* and at the same time permits the spindle to be fed inward or withdrawn. A hardened thrust collar *P*, which is a running fit on the spindle, takes the thrust of spring *Z*. The round-headed button *Y* is pinned to the spindle, and acts as a retainer for spring *Z*. The bellcrank *S* is mounted on a fulcrum stud held in the bracket *T*, and is actuated by a rod *U* which extends through the base to a foot-treadle near the floor.

When the machine is in use, it is merely necessary for the operator to pick up the part to be burred, place it between the points of the rapidly revolving drills, and step on the foot-treadle, which causes the spindle *R* to move forward, until the bellcrank *S* comes in contact with the screw-stop *V*. This stop is adjusted to suit the thickness

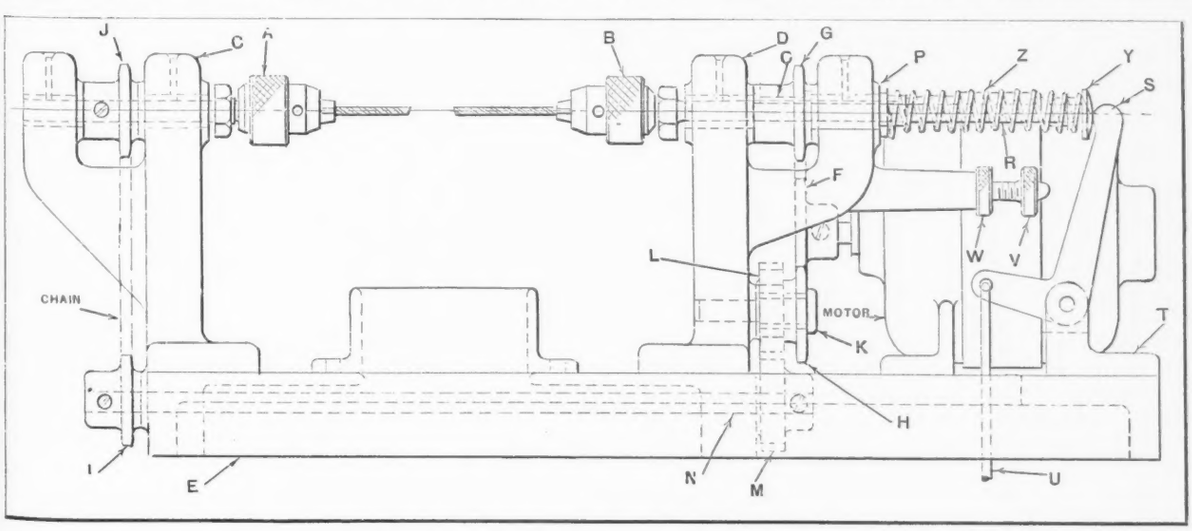


Fig. 2. Side View of Machine Illustrated in Fig. 1

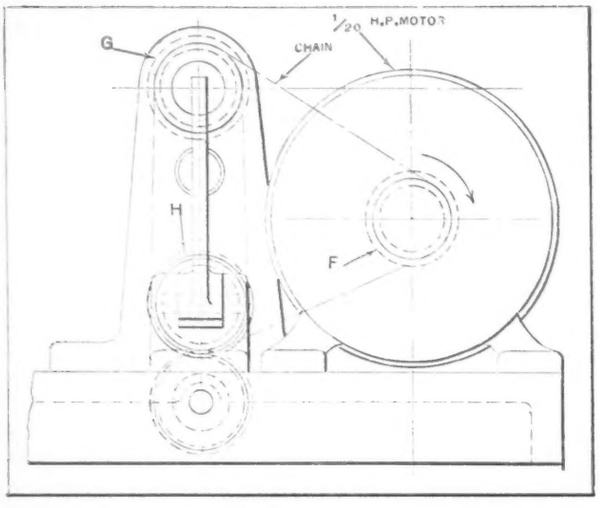


Fig. 3. End View of Motor and Chain Drive of Machine Shown in Figs. 1 and 2

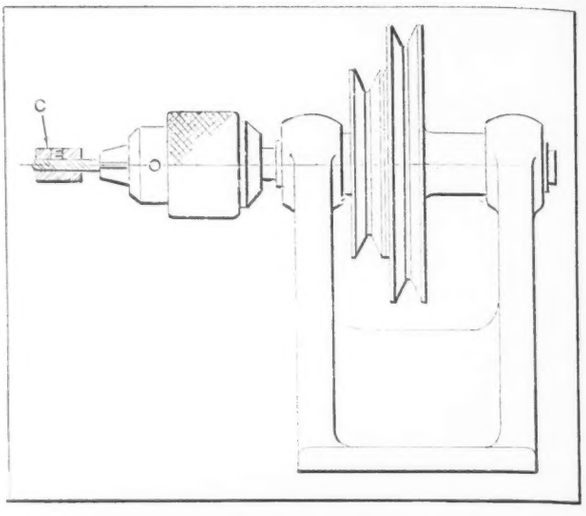


Fig. 4. Single-spindle Burring Head which was Superseded by Machine Shown in Fig. 2

of the part to be burred and is locked in place by the lock-nut *W*. The positive stop thus provided insures uniform burring of all parts. When the pressure is removed from the foot-treadle, the spring *Z* returns the spindle *R* to its original position, and the operator allows the part to fall through an opening in the base *E* from which a chute carries it into a stock-box on the floor.

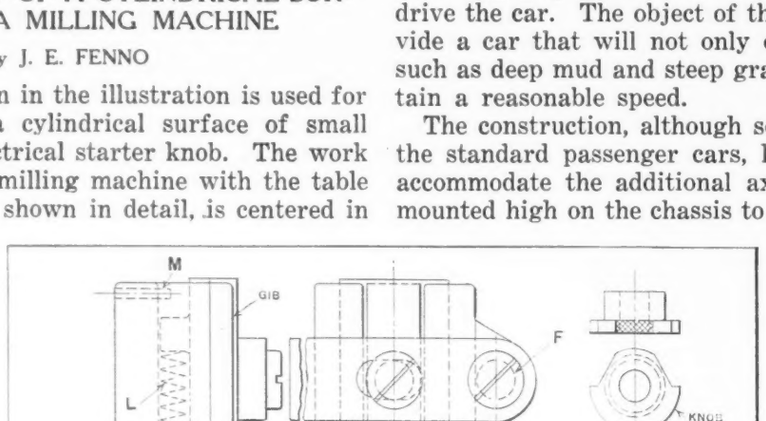
Fig. 1 shows the method of mounting the machines on the bench and the type of guards employed for the moving parts. The screen guard *X* protects the face of the operator from injury in case a part is caught and thrown off by the drills. The cost of burring with the machine shown in Fig. 1 is about 40 per cent less than with the older type of single-spindle machine shown in Fig. 4.

* * *

KNURLING PART OF A CYLINDRICAL SURFACE ON A MILLING MACHINE

By J. E. FENNO

The fixture shown in the illustration is used for knurling part of a cylindrical surface of small diameter on an electrical starter knob. The work is done on a hand milling machine with the table locked. The knob, shown in detail, is centered in the holder *B* and supported while being knurled by the plug *N*. The holder has a long shank which is a running fit in the casting *A*, and is imparted an oscillating motion by the action of the eccentric *G* fastened on the milling machine arbor *H*. The knurl *D* is mounted in the slide *E*, and is fed to the work by the hand-lever *J*. The latter, fulcrumed at *F*, acts against a shoulder screw in the slide. Spring *L* allows the slide to ascend against stop-pin *M* when the lever is released.



Fixture for Knurling Part of a Cylindrical Surface on a Knob

This arrangement has proved successful in doing the work described, the operator applying the necessary pressure on the lever for knurling with one hand, while the loading and removal of the knobs is done with the other. This type of fixture may also be adapted for marking pieces similar to that shown.

* * *

AUTOMOBILE WITH SIX-WHEEL DRIVE

Two six-passenger, six-cylinder automobiles of the six-wheel drive type have been built by a concern in Germany. Four of the drive wheels equipped with brakes are located at the rear, while the remaining two at the front steer as well as drive the car. The object of this design is to provide a car that will not only overcome obstacles, such as deep mud and steep grades, but also maintain a reasonable speed.

The construction, although somewhat similar to the standard passenger cars, has a sub-frame to accommodate the additional axle. The engine is mounted high on the chassis to allow the propeller shaft to pass under it to the front axle. This arrangement permits the car to pass safely through water to a depth of 27 inches without stalling the motor. A maximum speed of 43 miles per hour can be attained on the level; and it is claimed that the six-wheeled car has actually climbed grades as steep as 60 per cent.

Sheet-Metal Rolling and Forming Methods

Application of Rolling and Forming Machines in the Production of Tubular Sheet-metal Parts of Various Shapes

By FRANK H. MAYOH

THERE are few branches of the mechanical art that provide more interesting operating features than that in which sheet metal is made up into various tubular forms. Even in those branches of engineering where a high degree of skill obtains in the making of complex devices, there seems to be a lack of understanding as to how various sheet-metal parts of common utility are made. In the present article, tubular forming mechanisms are described, some of which are in common use, while others are more highly specialized. These descriptions may perhaps suggest ways of eliminating some of the difficulties experienced in the manufacture of various products.

Press Adapted for Tube Forming

The machine shown in Fig. 1 is adapted for making a large variety of tubular sheet-metal parts, such as can spouts, pan holders, or any parts similar to those shown in Fig. 2. This machine, in general appearance and structure, resembles a punch press having a crank-operated slide and bed.

From a study of Fig. 2 it will be noted that each of the parts shown has a seam at *A*. Whether the part shall be rectangular or oval, or whether it shall be straight or tapered is determined by the shape of the operative die members. The seam *A* invariably comes on the upper side of the piece in the position in which it is formed in the dies.

When the ram of the press *A*, Fig. 1, descends, the work is formed to a U-shape by the arbor *B*, which forces the blank against the lower die. The cam *C*, operating through an adjustable rod *D* and levers *E*, causes slides *G* and *H* to move inward. The dies attached to these slides thus complete the forming operation. The work of the operator consists simply of placing a flat metal blank in the die and tripping the lever *J* of the machine. Then the continuously revolving flywheel *K*, through a clutch mechanism, causes the machine to make one full stroke, which completes the forming of the part.

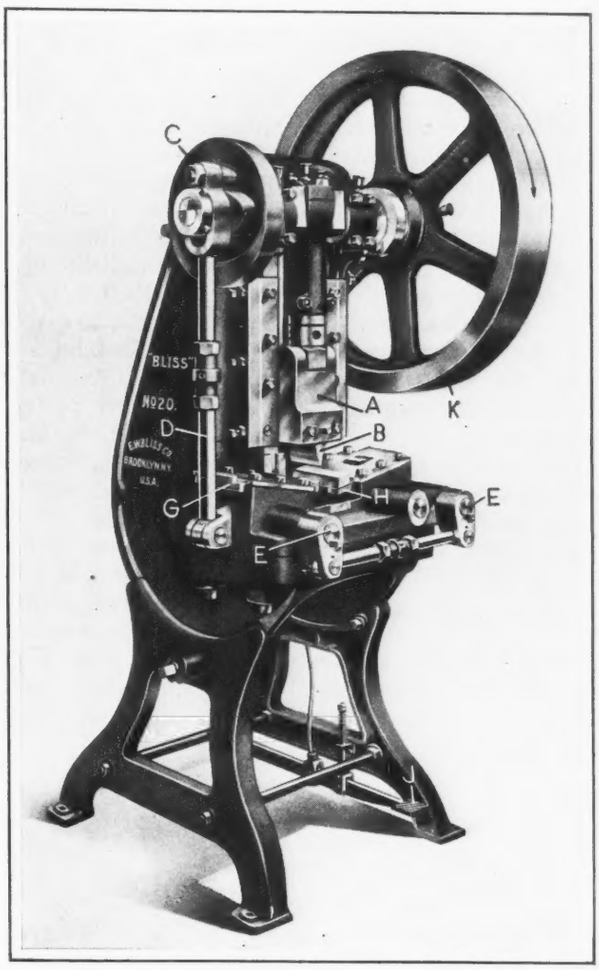


Fig. 1. Type of Press Used in Forming Tubular Sheet-metal Parts

Producing Oval Tube with Welded Lugs

In the rolling machine set-up, Fig. 3, is shown a tubular-shaped part *A* having a seam rolled at *B*. This tube has a lug welded to it at *C*, and is formed by dies in two bending operations.

The flat blank is first placed on top of a shallow bending die which forms the two radius ends *D* to shape. The part is then placed over another forming die and bent to the shape shown at *E*, although the lug *C* is not in the tube at that time. The opening *F* permits a forming punch supported in the ram of the press to extend inside the gap. With the exception of the shank, this punch conforms to the inside shape of the tube as it is formed. As the punch attached to the holder descends, it first strikes the work at *G*. This causes the tubes to be formed around the punch to the shape shown in the right-hand view. The tube is then withdrawn endwise from the punch while the ram is in the up position.

The lugs *C*, of which two or three are used, are then welded in the tube. The opening *F* permits the upper welding copper to pass inside the tube. The other welding copper is applied outside of the tube in order to make the proper spot contact for welding the lug *C* in place.

Closing the Seam by Rolling

The die for performing these operations is not illustrated, as the chief purpose of this article is to show rolling and forming operations. The gap *F* of the tube is next rolled together, so that the end appears as shown at *B*, Fig. 3. For this operation, a steel block *J* is provided which is shaped to fit the outside of the work. The tube is now set over and forced almost completely into the slot in block *J*,

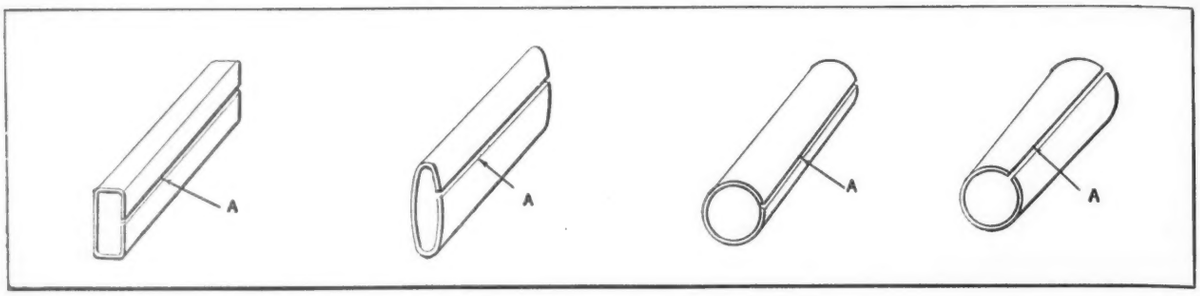


Fig. 2. Examples of Work Formed on Machine Shown in Fig. 1

using a mallet for rapping it in place. The block is clamped in a suitable holder secured to a table which travels longitudinally relative to a roll *K* that is free to revolve on an arbor of the rolling machine. As the tube *H* passes under the roll *K*, the seam is forced tightly together and the tube is wedged into its supporting block.

The machine for performing this operation has a table about 2 feet long, which travels longitudinally to the right or the left at a speed of about 60 feet per minute. An arbor in an adjustable bracket carries the free running roll *K*.

With the table stopped at one end of the stroke, the operator forces the tube into position in block *J*, and trips the table feed, causing the tube to pass quickly under the roll. The seam is thus closed by the action of the roll. It should be mentioned in this connection, that actually, the gap *F* is not nearly so great as indicated, the width being exaggerated for the sake of clearness.

A pair of wedges *L*, Fig. 3, one at each end of the block, pass through grooves in the block *J*. Sharp blows struck on the large ends of the wedges serve to force the tubes out of block *J*, in which they are inclined to stick.

Assembly Rolling Operations

The machine used for the seam-closing operation shown in Fig. 3 is also used for rolling the edges of a cover plate for a loose-leaf binder metal, of the type shown at *E*, Fig. 4. The roll *A*, which runs freely on an arbor *B* in the machine, has beveled surfaces at *C* and *D* that roll down the contacting bottom edges of the cover plate *E*. The ring binder metal has previously been assembled with a pair of toggle plates *F* in which the rings *G* are welded. The upper concave surface of block *H* fits the oval shape of cover plate *E*, and the notches at *J* and *K* provide clearance for the rings. The number of notches depends upon the number of rings in the binder, which is usually three, five, or seven. Block *H* must be a little longer than cover plate *E*.

Block *H* is held by side clamping screws to a holder attached to the table of the machine, which suits the particular cover plate to be produced. The roll *A* is adjustable so that the surfaces *C* and *D* will roll the cover plate edges down to the tension required to give a snap to the opening and closing of the rings of the binder.

It should be observed that cover plate *E* is formed substantially to the shape shown before being assembled with the other members and before being placed on block *H* for the rolling operation. In fact, it is left open only a slight amount for convenience in assembling. For the rolling operation, the assembly is placed in block *H* and the machine table allowed to pass rapidly under roll *A*, which is adjusted to the proper tension.

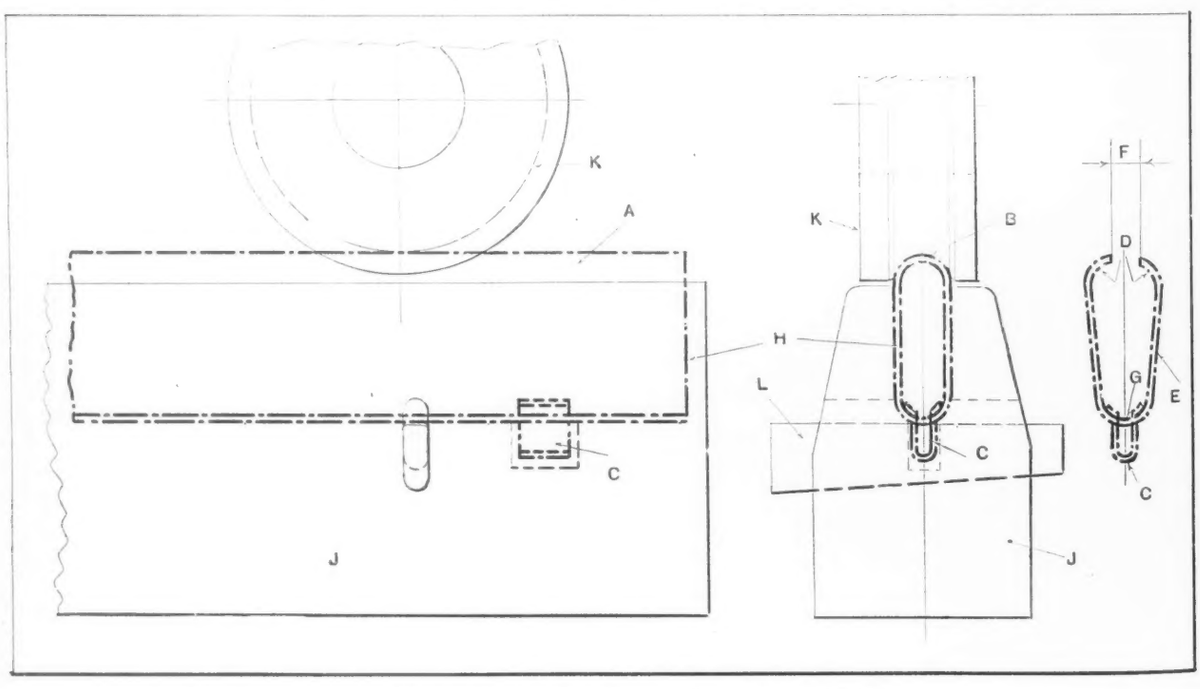


Fig. 3. Method of Closing Seam in Tubular Part by Rolling

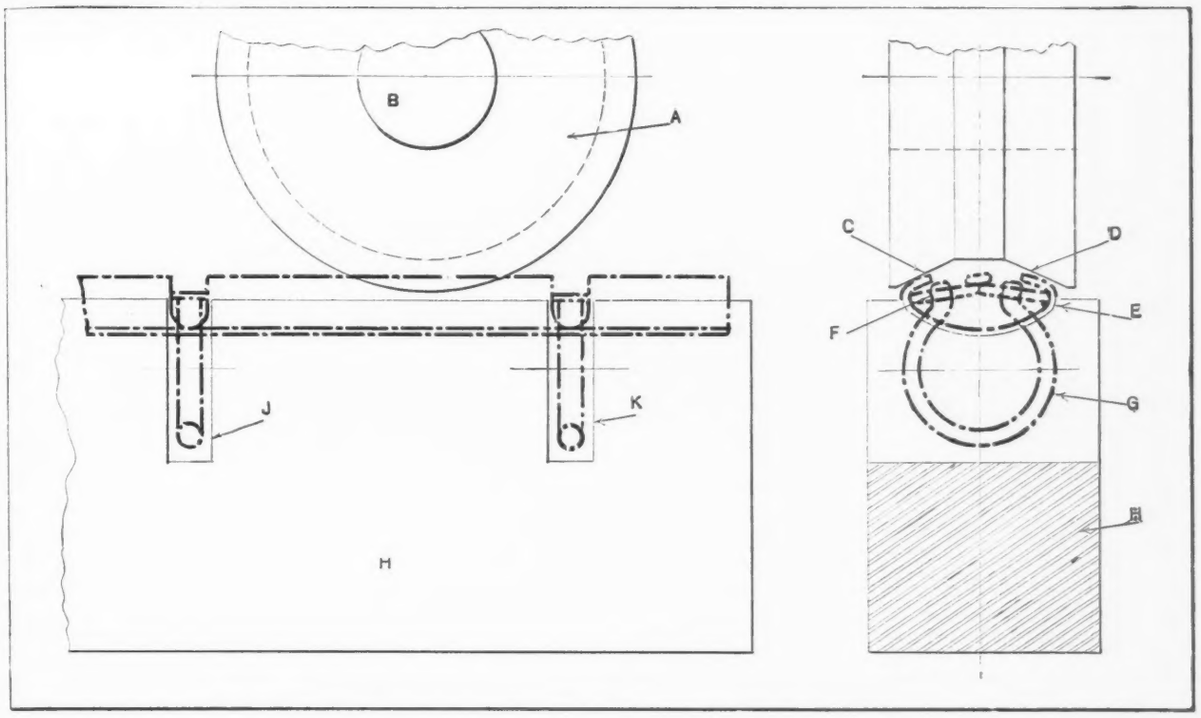


Fig. 4. Assembly Rolling Operation on a Cover Plate for a Loose-leaf Binder Metal

When the table reaches the end of its travel in one direction, it stops automatically, another ring binder is put in position, and the table then travels in the opposite direction. A comparatively light weight machine is satisfactory for rolling operations of this kind.

Other examples of sheet-metal rolling and forming methods will be dealt with in later articles.

* * *

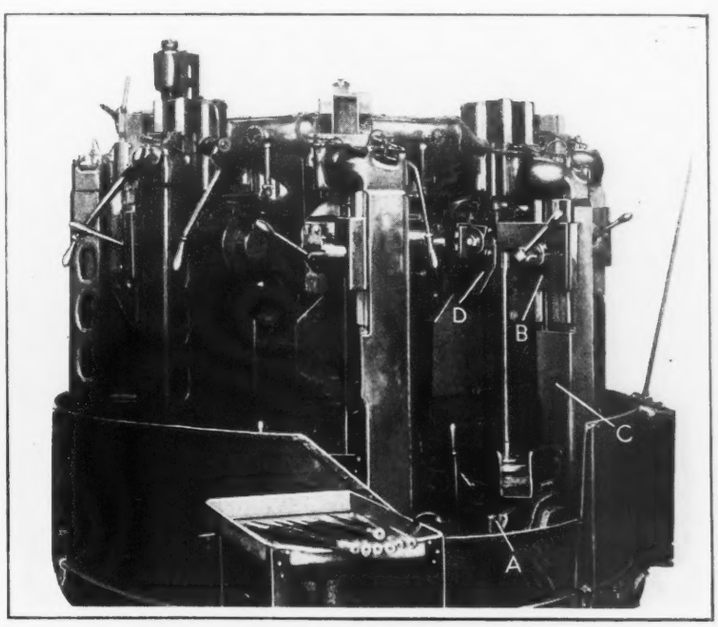
THE CAMPBELL MEMORIAL LECTURE

Dr. Albert Sauveur, Gordon McKay professor of metallurgy and metallography at Harvard University, has accepted the invitation of the American Society for Steel Treating to present the E. D. Campbell Memorial Lecture for 1929 during the National Metal Congress and Exposition to be held in Cleveland during the week beginning September 9. Dr. Sauveur's lecture will be presented Wednesday morning, September 11. The E. D. Campbell Memorial Lecture was established by the directors of the American Society for Steel Treating in 1926 in memory of its honorary member, Dr. Edward DeMille Campbell of the University of Michigan.

HOBBING SPLINES IN REAR-AXLE SHAFTS

Automobile rear-axle shafts are spline-hobbed at the rate of 120 shafts per hour in the Plymouth plant of the Chrysler Corporation, Detroit, Mich., on the machine here illustrated. This machine is of a continuous rotary type with eight work-holding units. As each unit passes the front of the machine an axle shaft is loaded into it, and by the time that unit again reaches the loading position, the part is finished. In this operation, ten splines are cut in the upper end of the axle shafts for a length of 1 11/16 inches.

Each work-holding unit consists of a lower workhead *A* which drives the part, an upper tailstock *B*, and a vertical column *C* on which both the workhead and tailstock are mounted. As the main housing of the machine revolves, each work-holding unit is fed gradually upward by a cam, carrying the end of the work being splined past a hob held in a corresponding cutterhead *D*. When the units reach the loading position, they drop to the lowest point of the cam. Each unit weighs about 800 pounds. This machine was built by the Cleveland Hobbing Machine Co., Cleveland, Ohio.



Continuous Rotary Type of Machine which Hobs Splines in Rear-axle Shafts at the Rate of 120 Shafts per Hour

A Combined Boring-bar and Grooving Tool

An Ingenious Combination Tool Solves the Production Problem on a Boring and Internal Grooving Job Performed on a Regular Turret Lathe

By B. J. STERN

A COMBINED boring-bar and internal grooving tool is shown in Fig. 2. This tool is used for finishing the bore in the casting shown in dot-and-dash lines at *A*, and at the same time cutting the groove *B* in the wall of the bore. The groove is required to be a given distance *C* from the bottom of the finished hole, the dimension being held to close limits. The work *A* is held in a pot chuck on a Warner & Swasey turret lathe, the hole being first roughed out with a boring-bar of conventional design. After this operation, the finishing and grooving tool is brought into place.

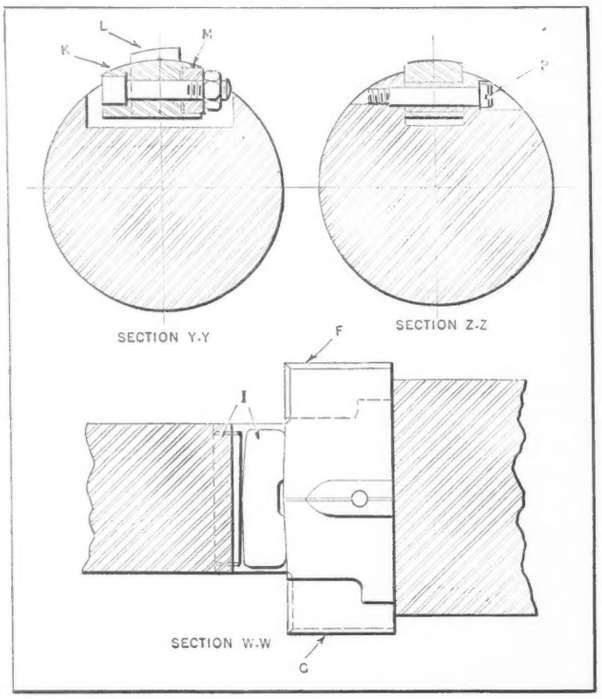


Fig. 1. Cross-section Views of Tool Shown in Fig. 2

The bar is gripped by the shank *D* in the turret of the lathe, and has a hardened and ground pilot *E* which fits a bushing in the lathe spindle just behind the chuck. The body of the bar is slotted, as shown, to receive the boring cutters *F* and *G*, which are arranged as indicated in the cross-section *W–W*, Fig. 1. These cutters can be expanded by means of the cone point of the screw *H*, Fig. 2. This point fits corresponding angular cuts in the back ends of the boring cutters, and when screwed down, causes them to spread apart equally, thus providing a fine adjustment for finishing the hole to the close limits desired. The wedging arrangement shown at *I*, Fig. 1, clamps these cutters in place, when they are once set.

Projecting in front of the edge of the boring cutters is the hardened stop-plate *J*, Fig. 2, which is fastened to the plate *K* by screws. This plate moves in a groove cut in the body of the bar, and contains the grooving tool bit *L*, which is clamped in its slot in the plate by the strap *M*. The groove in the boring-bar is cut here to provide clearance for a clamping

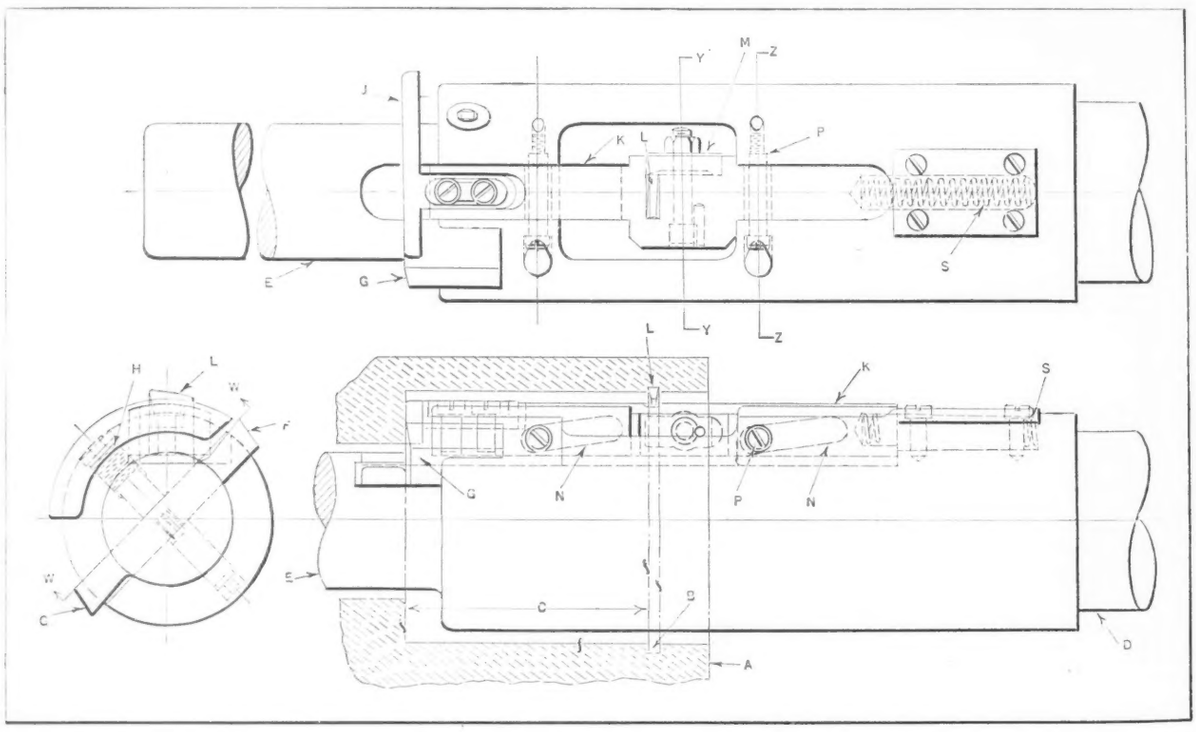


Fig. 2. Combination Boring-bar and Grooving Tool

wrench, as shown in the sectional view *Y–Y*, Fig. 1. Two grooves *N*, Fig. 2, are cut at an angle in the grooving tool plate *K*. Each groove contains a hardened and ground bushing through which screw *P* passes, this screw being contained in the body of the bar. The sectional view *Z–Z*, Fig. 1, shows this construction.

In operation, the bar is fed into the rough-bored hole, so that the pilot bar *E* leads or aligns the cutters *F* and *G* when taking the finishing cut. The stop-plate *J*, extending in front of them, strikes the bottom of the hole while the bar is continuing its forward motion, causing plate *K* to move back in its slot against the pressure of the spring *S*. The tool bit *L*, rising with plate *K*, cuts into the wall of the finished hole to the required depth, and then moves forward a few thousandths of an inch, the movement being stopped when the cutters *F* and *G* reach the bottom of the hole. Since the distance *C* from the face of the stop-plate *J* to the tool *L* is fixed, dimension *C* is kept within the required limits. When the operation is complete, the bar is pulled back, releasing the pressure against spring *S* and allowing it to push back plate *K* until cutter *L* clears the finished bore of the work.

* * *

The American Association of Engineers, 63 E. Adams St., Chicago, Ill., is planning to award annually a medal known as the Clausen Medal to the engineer or other person who performs the most distinguished service during the previous year for the welfare of engineers in their social or economic position. A committee of eminent engineers and leaders in industry will select the recipient of the medal. The committee for the present year includes, among others, L. W. Baldwin, president of the Missouri Pacific Lines; C. F. Kettering, general director of the General Motors Research Laboratories; Michael J. Pupin, professor of the Department of Physics, Columbia University; and W. L. Saunders, chairman of the board of the Ingersoll-Rand Co.

Logarithms of Gear Ratios

Numbers of Teeth	Logarithm of Ratio	Numbers of Teeth	Logarithm of Ratio	Numbers of Teeth	Logarithm of Ratio	Numbers of Teeth	Logarithm of Ratio
127:16	0.899684	127:42	0.480555	127:68	0.271295	127:94	0.130676
17	0.873355	43	0.470336	69	0.264955	95	0.126080
18	0.848531	44	0.460351	70	0.258706	96	0.121533
19	0.825050	45	0.450591	71	0.252546	97	0.117032
20	0.802774	46	0.441046	72	0.246472	98	0.112578
21	0.781585	47	0.431706	73	0.240481	99	0.108169
22	0.761381	48	0.422563	74	0.234572	100	0.103804
23	0.742076	49	0.413608	75	0.228743	101	0.099483
24	0.723593	50	0.404834	76	0.222990	102	0.095204
25	0.705864	51	0.396234	77	0.217313	103	0.090967
26	0.688831	52	0.387801	78	0.211709	104	0.086771
27	0.672440	53	0.379528	79	0.206177	105	0.082615
28	0.656646	54	0.371410	80	0.200714	106	0.078498
29	0.641406	55	0.363441	81	0.195319	107	0.074420
30	0.626683	56	0.355616	82	0.189990	108	0.070380
31	0.612442	57	0.347929	83	0.184726	109	0.066378
32	0.598654	58	0.340376	84	0.179525	110	0.062411
33	0.585290	59	0.332952	85	0.174385	111	0.058481
34	0.572325	60	0.325653	86	0.169306	112	0.054586
35	0.559736	61	0.318474	87	0.164285	113	0.050726
36	0.547501	62	0.311412	88	0.159321	114	0.046899
37	0.535602	63	0.304463	89	0.154414	115	0.043106
38	0.524020	64	0.297624	90	0.149561	116	0.039346
39	0.512739	65	0.290891	91	0.144763	117	0.035618
40	0.501744	66	0.284260	92	0.140016	118	0.031922
41	0.491020	67	0.277729	93	0.135321	119	0.028257

Machinery

GEAR RATIOS FOR 127-TOOTH GEARS

By WILHELM MERCHANT

Lathes and thread milling machines, as well as numerous special machines having lead-screws with a certain number of threads per inch, make use of a 127-tooth gear for cutting metric pitches. Therefore, as an addition to the tables on pages 948 to 971 of MACHINERY'S HANDBOOK, sixth edition, the writer has prepared a table of logarithms for all gear ratios from 127:16 to 127:119. The use of this table will be illustrated by the following example:

Suppose motion is to be transmitted by gears, the required ratio for a special purpose being 381:126. We may proceed in either of two ways: First, divide 381 by 126, thus reducing the ratio to 3.0238:1, and find the log of this ratio, thus

$$\text{Log } 3.0238 = 0.480554$$

Consulting the table, it is found that the logarithm of the gear ratio 127:42 is 0.480555. Thus by using a 127-tooth gear and a 42-tooth gear there is only a very small ratio error, which is negligible.

The second method of calculating the proper gear ratio is to apply logarithms directly to the ratio 381:126, thus:

$$\begin{aligned} \text{Log } 381 &= 2.580925 \\ \text{Log } 126 &= 2.100371 \\ \text{Subtracting} \quad & \quad 0.480554 \end{aligned}$$

By comparing results, it is seen that this figure exactly corresponds with that obtained by dividing 381 by 126 and finding the log of the resulting ratio.

Suppose the table printed here were not used, but instead the ratio 381:126 was calculated by the use of the table on pages 948 to 971 in MACHINERY'S HANDBOOK. Then

$$\text{Log } \frac{381}{126} = 0.480554 = 3.0238 \text{ inches}$$

The nearest log ratio to this in the table is 0.480817, which corresponds to the gear ratio 118:39, and equals 3.0256 inches. In many problems this error would be too large. Also, in most cases, both the 118-tooth and the 39-tooth gears would have to be cut specially.

* * *

CHICAGO PLANS WORLD'S FAIR IN 1933

A World's Fair is planned to be held in Chicago in 1933 marking the one hundredth anniversary of the settlement of the city. It is proposed to make this World's Fair quite different from similar events of the past. It will not be a trade fair at which are displayed miles and miles of manufactured products. Instead, it is planned to arrange for cooperative displays of the leading industries of the nation, and to arrange to have actual operating exhibits, rather than mere product displays.

What MACHINERY'S Readers Think

A Department for the Interchange of Ideas on Problems of Management, Foremanship, and Employe Relations

RESEARCH LABORATORY SERVICE FOR SMALL SHOPS

Shop executives in general are beginning to realize the value of subjecting their technical problems to scientific analyses by so-called "theoretical men." In these days, the reduction in cost, and the improvement of a product, are being brought about more and more by applying scientific research to methods and materials, rather than by mechanical ingenuity.

The small concern that cannot afford to maintain its own research laboratory can generally find a thoroughly equipped laboratory and an expert staff available at the nearest engineering college. As a rule, the professors are anxious to undertake work for manufacturing concerns, as this enables them to keep in touch with the latest methods and the practical problems of industry.

PETER DE PASQUAL

A FORUM FOR SUPERINTENDENTS

In some cities, a forum for the discussion of manufacturing problems in the various factories has been established. The forum is attended by superintendents from plants manufacturing similar products, men interested in kindred problems being grouped together. The basic idea is the fostering of a common interest by bringing the superintendents from different shops into closer contact, with an opportunity for informal discussion of mutual manufacturing problems.

A stenographic record is kept of these meetings, and copies covering the more essential points of the proceedings are sent to those attending. Through these gatherings, and the exchange of information, it is expected that the men as well as the industry itself, will derive considerable benefit.

HARRY KAUFMAN

BUY RESULTS, NOT MERE MATERIALS

"Buying on performance" should be the slogan for all progressive and efficient companies. Testing for performance before buying is a good policy. Theoretically, every shipment of every item purchased should be tested either by laboratory or shop performance before the goods are accepted and paid for. The usual procedure is to have the important items tested always, and to test the less important items just often enough to see that the standard is kept up. The same method can be applied to tools purchased for shop use; in that case, an actual test on production work will give the purchaser a good idea of the quality of the tools he is contemplating purchasing, and he can be guided accordingly.

The careful day-to-day inspection, as well as the pre-purchase check of all material, acts as a scientific check on quality; small variations in quality will be caught and corrected in this way. When products are made from material of uneven quality, waste is usually a large element in manufacturing costs, and anything that the manufacturer can do to reduce it, will repay his efforts.

After all, economy is determined by final cost. This is the best guide for the purchasing agent. He will be able to figure the price he ought to pay on the basis of actual production obtained with each type of tool used, rather than on the cheapness of the tools.

E. ACKERMAN

CHEAP DRAWINGS MAY BE EXPENSIVE

The drafting-room is often looked upon as an overhead expense—a non-productive department. In recent years, to save expense, drawings are often made directly on tracing cloth in pencil, thus eliminating the time and expense of making the drawings first on heavy paper and then tracing them on cloth in ink. Some drafting-rooms even go further, and send free-hand sketches to the shop, to save the cost of making drawings.

Do these practices pay in the long run? It is only natural that if drawings are rushed through and issued to the shop without being properly checked, errors will be made. When these errors are reproduced in iron and steel, they are very costly. The cost of making drawings for the production of articles, of which perhaps thousands will be manufactured, is negligible as compared with the cost of scrapping material because of errors in drawings. It pays to use drawings that are clear and distinct and that have been carefully checked.

MORTON SCHWAM

THE NEWLY HIRED MAN

My experience in hiring men during many years, and being responsible for their productive efforts, has caused me many hours of serious contemplation. I have found that a large percentage of old employes assume a hostile attitude toward new men, some going so far as to place obstacles in their way. They hide their tools, refuse to give helpful hints, and embarrass the newcomers by making fun of them. As for "past history," if a new man is known to anyone in the shop, his reputation quickly becomes public property; and if he has ever spoiled a job in his life, at some other place, he is likely to hear about it. Then there is always the question of religion, ready to cause an unfair reaction among the older men; for they often view life through a very small aperture.

I have found that the best way to handle a new man, is personally to introduce him by name to not less than six "regulars." I select the six who will work nearest to him, which will generally make

him feel at home. Then I appoint one of the six as his instructor for a few days. I make this procedure thoroughly understood, so that no one will misinterpret. The superintendent or foreman of a big plant cannot always give a new man all the attention he needs. He requires a great deal of information: his lathe may bore large at the back end; he will want an oil-can, waste, a file, and a dozen other things. If these items are supplied quickly, the breaking-in cost will be materially reduced.

Make the new man feel at home as quickly as possible, for best results.

RAYMOND H. DAUTERICH

PRICES FOR REPAIR PARTS

What price should the builder of a machine charge for spare parts? The most equitable price for repair parts would seem to be one based on the cost of manufacturing the parts plus the cost of keeping them in stock plus a reasonable percentage of profit. However, the machine builder should not overlook the fact that low prices for spare parts will make satisfied customers. Good will of buyers will prove more valuable in obtaining future business than high-priced repair parts.

A low price may, therefore, be charged for repair parts as long as the parts are in production, taking them from regular stock. After a model becomes obsolete, a percentage should be added every year to cover handling charges. At the end of a given period, depending on the business, all parts should be considered special and charged for accordingly, whether actually in stock or not. JOSEPH BELL

HANDING THE CUSTOMER THE PROFIT

Many manufacturers appear to me to be very generous with their customers. As near as I can determine, they are not only selling good products at a fair price, but in addition, they hand the customer the profit on the transaction. This is evident from the low prices on tools and special equipment that many manufacturers quote. It is also evident from the balance sheets of many firms engaged in the machine shop industries, because after they have been in business for a great many years, their assets are sometimes smaller than their original paid in capital. In other words, they have handed the customers not only their profits, but also the amount that they should have set aside for depreciation. That is not good business, and conditions will be more satisfactory for everyone engaged in the industry when those, who are now in the habit of doing so, stop handing the customers their profits. MANUFACTURER

MAKING SHOP INSTRUCTIONS CLEAR

According to production managers, a large percentage of spoiled work is due to the worker not being well instructed. One great trouble seems to be that few foremen are good teachers. It is not sufficient for them to know how to do the job themselves—they must have the ability to show the other fellow how to do it. When a foreman is thoroughly familiar with a job, he often overlooks small details that seem self-evident. If the workman is asked whether he understands, he usually says "yes," whether he does or not, for fear of being thought ignorant.

Someone has said that a good foreman must be able to make work attractive, so that the men will want to do the job and do it right. Most foremen tire of repetition; hence they fail to impart interest to the men, but a good foreman must show enthusiasm day after day.

Another serious handicap to the average foreman is that he forgets how little he knew when he was a learner, and loses patience when the man instructed overlooks some point that he has probably not made clear. Then, too, the foreman is inclined to teach the thing he learned last, instead of leading up to it in proper sequence.

There seems to be little doubt that proper instruction has its place in every plant. The larger the plant, the more necessary the instruction.

GEORGE HASK GUNN

SALVAGING MEN AND WORK

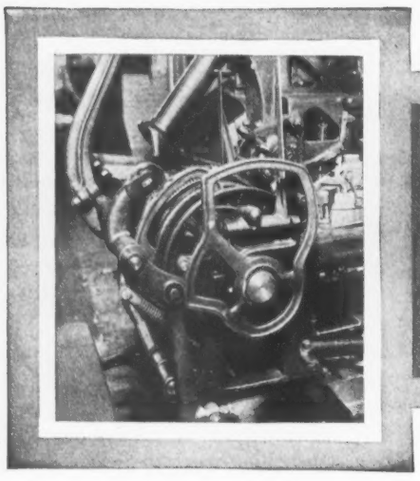
One of the greatest tragedies of life to persons reaching old age is loss of employment due to the fact that they are unable to do the work of former days. Even though the savings of a lifetime may be sufficient to keep them to the end of their days they want to feel that they are serving a useful purpose. For those who are in actual need, loss of employment is even more serious.

Many industrial concerns foster benefit associations that help to support employes laid off when they become old, but how much happier aged men would be if they could continue to work and receive the amount of wages to which they have been accustomed! One prominent automobile concern has successfully evolved such a plan.

Employes who have given years of loyal service and are no longer able to keep up with standard working schedules are assigned to a department engaged in reclaiming parts that have not passed inspection because of minor defects. The men are allowed all the time they require in remachining the parts and are paid by the company according to the actual value of the work performed. However, the difference between this sum and the wage that the man formerly received while working in the shop is made up from a pension fund which is maintained by the company and the employes in cooperation.

For example, if an old toolmaker is able to turn out only about 50 cents worth of work per hour and his wage was formerly 95 cents per hour, the pension fund pays him 45 cents for each hour and the company 50 cents. The man himself does not know how much the company considers his work worth, as he receives his total pay in one envelope, the same as regular shop employes. Many of the men are invaluable in this salvaging department, because during their years of employment they have become experts in machining certain parts and know how these parts can best be reclaimed.

OLIVER HERBERT



Ingenious Mechanical Movements

ELLIPTICAL MOTION MECHANISM

On page 261 of December MACHINERY is described one of several interesting mechanisms incorporated in the automatic hat crown finishing machine made by Doran Bros., Danbury Conn. In the present article is described the oval or elliptical motion mechanism employed on the same machine. The finishing is done by a pad *P* indicated in diagram *B*, Fig. 1. The hat is mounted on a block held on the face of the chuck *L*, Fig. 2. The spindle *E* revolves continuously while the pad travels from the position shown at *P* in the view *B*, Fig. 1, at the tip, to the position indicated at *p*.

As the pad is secured to an arm which swings about a center line at right angles to, and intersecting with, axis *X*–*X* of shaft *E*, Fig. 2, it is necessary that the block on which the hat is mounted be raised and lowered during its rotary movement in order to compensate for the difference in the lengths of the major and minor axes of the elliptical outline of the crown, and thus maintain the proper contact between the work and the finishing surface of the pad.

Thus, when the major axis is in the vertical position, as indicated by the full lines in diagram *C*, Fig. 1, the center of the block on which the hat is mounted will be located at point *D*, and when in the horizontal position, as indicated by the dotted lines, the center will be raised to the point *E*.

In addition to the mechanisms required to produce the motions described, there is also a mechanism which changes the angular velocity of the work, so that a uniform surface speed is maintained at the point of contact with the finishing pad. During the travel of the pad from the tip to the band of the crown, it is reciprocated rapidly by means of the mechanism described in December MACHINERY.

The maximum stroke of the pad is 1/2 inch and the speed 1200 strokes per minute. The finishing surface of the pad consists of sandpaper mounted on rolls in such a manner that it can be automatically fed along to keep an unworn surface in the working position. The mechanisms required to produce the rather complicated combination of motions are rendered more intricate by the necessity for making adjustments to suit different styles or shapes, such as shown at *A*, Fig. 1.

By varying the stroke of the pad at different points on the contour and by adjusting the angular-velocity mechanism and the elliptical or oval mechanism, it is possible to obtain practically an unlimited number of finishing effects. Obviously, the angular velocity and the elliptical motion mechanisms must be properly synchronized. The magni-

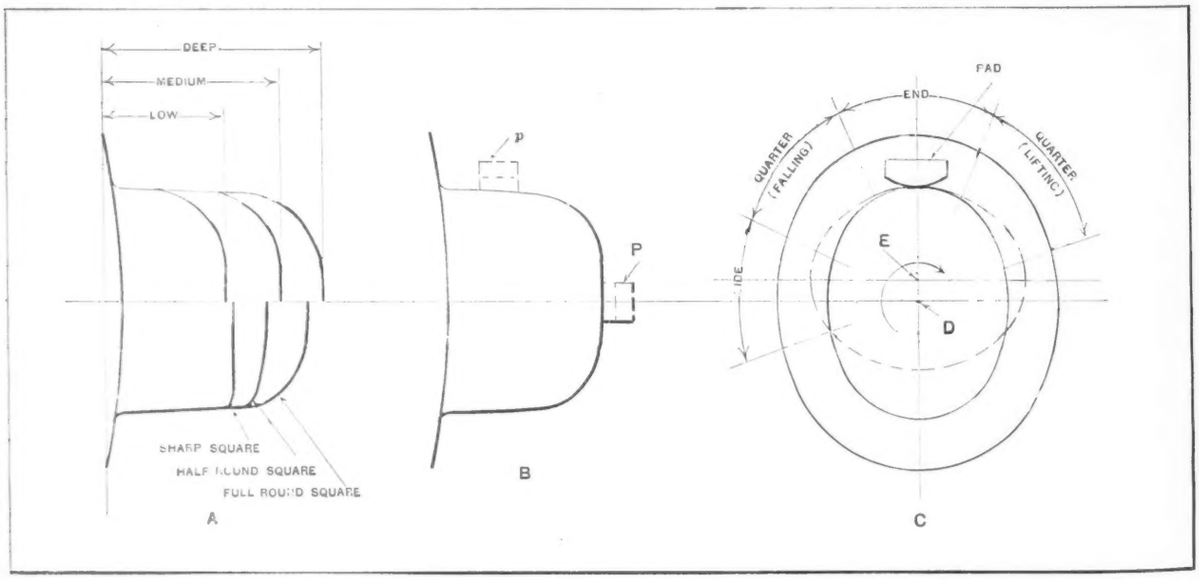


Fig. 1. Diagrams Used in Describing Mechanical Movements Produced by Mechanism Shown in Fig. 2

tudes of their effects, as well as their timing, must be individually adjustable. Synchronism of the two mechanisms is obtained by control rods and levers operated by the same cams. This cam is mounted on the shaft *O*, Fig. 2, which is driven by the spindle *E* through a worm and worm-wheel.

The velocity-changing mechanism will be dealt with in a separate article, the present description being confined to the elliptical motion mechanism. Referring to Fig. 2, the vertical ways *A* are rigidly secured to the casting *B*, which, in turn, is secured to the frame *C*. The hub of the revolving plate *D*, secured to shaft *E*, extends through the center of a cam mounted on shaft *O*, and previously referred to as controlling both the angular velocity and elliptical motion mechanisms. It is obvious that when the cam groove in member *F* is concentric with shaft *E*, the chuck *L* will revolve about the axis *X*–*X*. When member *F* is raised, however, the chuck will be carried upward.

As shaft *E* continues to revolve, the chuck will gradually drop back until the center again coincides with line *X*–*X*, at which time it will commence its upward movement, reaching the maximum position when the shoe *I* is diametrically opposite the position shown in the illustration. Thus it is obvious

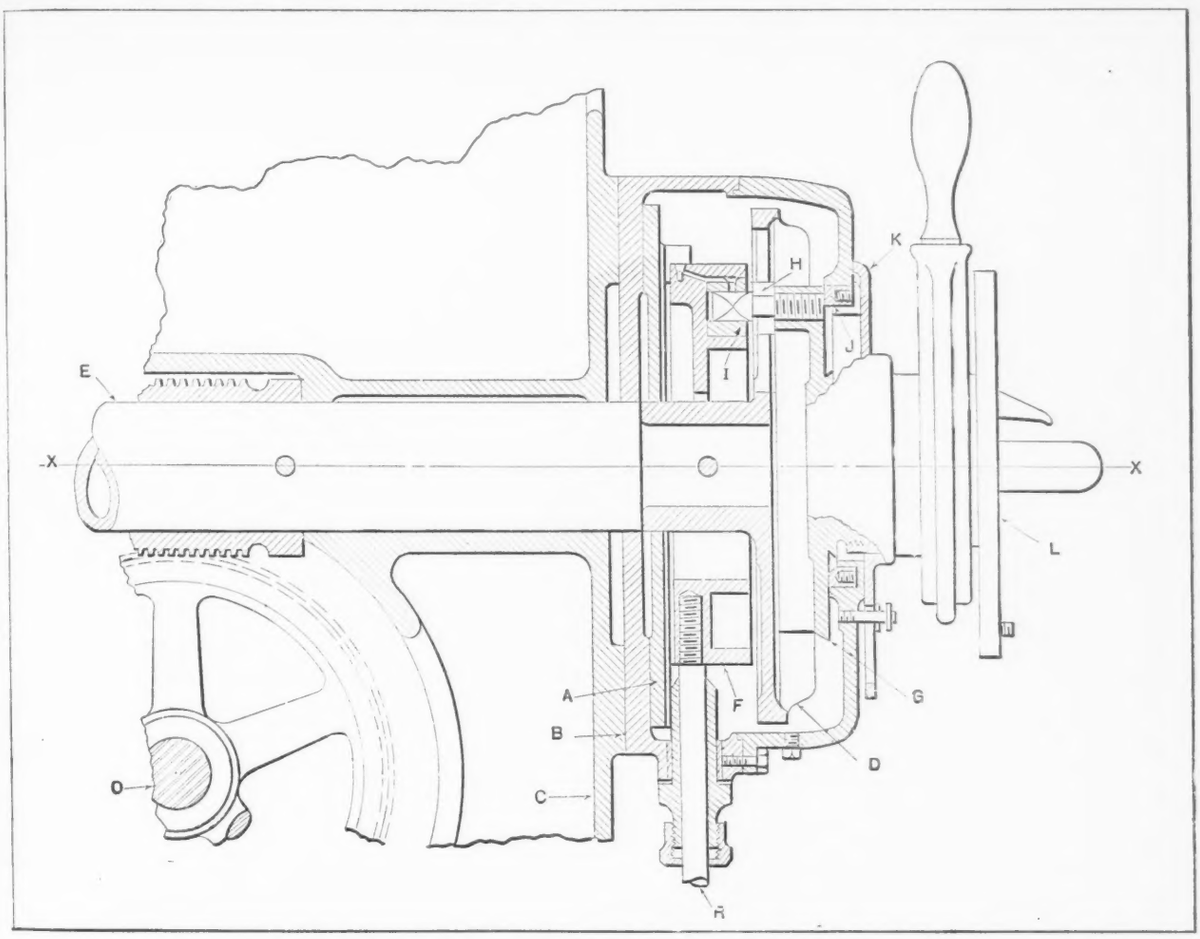


Fig. 2. Mechanism which Gives Block Chuck of Hat-finishing Machine Adjustable Oval Movement

the vertical ways *A*. In the V-ways *A* is freely mounted the part *F*, on the front side of which is cut a cam groove. A centrally located elongated slot in part *F* permits free vertical movement of the latter member in relation to the stationary vertical ways *A* and to the hub of plate *D*.

The revolving plate *D* is secured to shaft *E*, and has on its front face, V-ways in which is mounted the part *G*. To part *G* is secured the chuck *L* which holds the block on which the work is mounted. In the flanged plate *D* is a radial slot, through which extends the stud *H*. One end of stud *H* is screwed tightly into part *G*, while the opposite end forms a free mounting or pivot pin for the segmental shoe *I*. The segmental shoe is a close working fit in the cam groove. The cam groove thus serves to restrain or control the movement of slide *G*.

The vertical position of the member *F* is controlled by the rod *R*, which, in turn, is actuated by that by suitable cam control of the rod *R*, any required oval or elliptical movement of the work can be obtained.

* * *

SAFETY GUARDS FOR POWER PRESSES

An instructive pamphlet, profusely illustrated, known as "Safe Practices Pamphlet No. 18—Power Presses" has been published by the National Safety Council, 108 E. Ohio St., Chicago, Ill. This pamphlet will prove of value to every plant having one or more power presses at work in its shop. The pamphlet begins with a review of the causes of power press accidents, and proceeds to review feeding methods, treadle disconnecting attachments, methods of removing materials, arrangement of operating levers, etc. It describes and shows clearly the kind of guards that have been successfully used in practice for different purposes.

Keeping Polishing Wheels in Good Condition

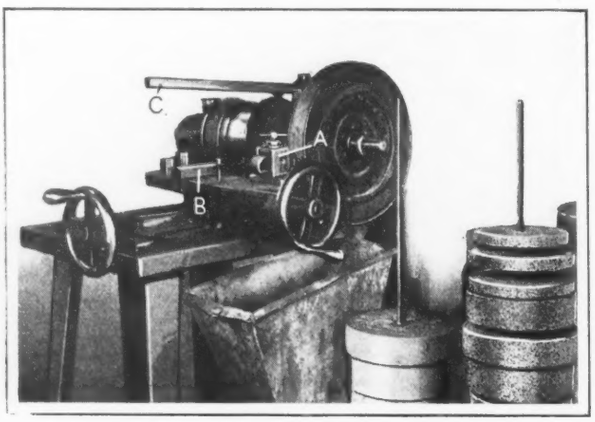
Methods Employed in Removing Abrasive from Worn Wheels and in Truing and Recharging the Polishing Surfaces

By DONALD A. HAMPSON

MANUFACTURERS who have neglected to keep their polishing departments properly equipped or are still employing old out-of-date methods are beginning to realize the necessity for making improvements in this branch of their production work. Polishing has always been classed as an important operation by the Schrade Cutlery Co., Walden, N. Y., in the production of high-grade pocket knives. The methods employed by this company, which are described in the present article, will doubtless be of interest to many production managers. The practice followed gives uniform results and is based on years of experience and careful study of the requirements.

Equipment of Polishing Wheel Room

All polishing wheel conditioning operations are performed by an experienced man in a well-equipped wheel room. Here the abrasive is removed from the worn wheels, and the wheels are trued up and recharged, ready to be sent out to the foremen of the various polishing rooms. Centralized equipment and responsibility, together with modern methods, have resulted in the production of uniform wheels that can be depended upon to do their work properly.



Lathe for Dressing Worn Polishing Wheels

The worn wheels are never soaked in order to soften the glue, although properly dried leather is not supposed to be injured by wetting. The chances of a built-up or banded polishing wheel being thoroughly dried are slight, and repetition of this treatment can only fail to bring about an uneven and undesirable wheel.

Dressing the Worn Wheel

All the wheels are dressed off in the lathe shown in the accompanying illustration. An abrasive block *A* is used as a tool, and is fed across the worn wheel as it revolves on a mandrel. This operation is similar to that of metal turning as done in regular machine shop practice. The lathe has a funnel connected with the exhaust system of the plant for the removal of the cuttings. The neat appearance and small space occupied by the lathe are factors that make the dressing method of removing the abrasive preferable to the older method of "soaking," with its mussiness and deteriorating effect on the wheels; but the main thing is that the method is more economical and gives better results.

Applying Glue to Polishing Wheels

Animal glue of the first quality is used for charging the wheels. The service required of the glue is such that only the best can be considered economical. The price is generally a direct indication of the quality. The strength of the glue is destroyed by bacterial action. As a matter of fact, the bacteria act so rapidly that glue kept overnight will be found decidedly inferior the following day, and it cannot be restored by adding fresh stock. In the wheel room described, only small amounts of glue are prepared each day, so that the surplus to be discarded at night is small. A steam-heated stand provides space for the glue pots in which the glue is soaked, for the heating of water, and for several pots in which glue is kept in the liquid state ready for instant use.

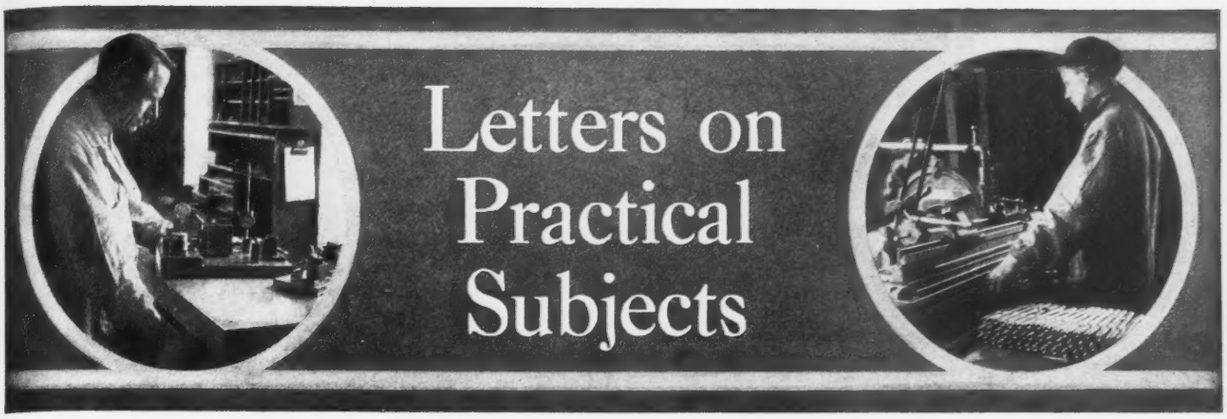
Temperatures are regulated according to thermometer readings. Even the water that is added to the glue is raised to a temperature of 160 degrees before using. The dry glue is weighed, as is the water. In this way, uniform glues of the consistency and strength found best adapted for each job are obtained month after month. It is found that this careful preparation of glue takes very little more time than the haphazard way so often employed.

Applying the Abrasive

After the worn wheels are ground off to provide a true concentric surface, they are coated with the glue and rolled carefully in the abrasive. An even coating is essential to smooth cutting, and any unevenness adds to the amount of work required in obtaining a good finish on a knife blade. The abrasive grains are kept in special pans which are wider than the face of any polishing wheel in use, and long enough to permit the largest wheels to make a complete revolution at a single rolling. It is important to note that the abrasives are kept warm and that no chilled grains are rolled into the glue, which is kept at its proper temperature.

* * *

Orders for locomotives and freight cars have greatly increased this year, as compared with the early part of last year. At the present rate, the output of both locomotives and freight cars this year will be 50 per cent greater than last.



ECONOMY OF PROPER OIL STORAGE

The loss of oil or lubricants due to unsuitable storage facilities is often much greater than plant executives realize. There is sure to be considerable wastage in a plant where the oil storage system consists simply of barrels located at different points throughout the plant, from which the operators obtain a bucket of oil whenever they believe it is required for their machines. This system is still in use in plants that may be considered modern in every other respect. In contrast with this, is the plant provided with suitable oil tanks, where there is a strict rule that oil is to be issued to an operator only upon the presentation of a properly signed requisition from the foreman. From these requisitions, the foreman can readily ascertain whether or not the worker is using too much or too little oil.

The strictly modern method is to have the oil tanks in tandem, one tank being used for new oil and the other for used oil. A pipe system may also be installed which will deliver the oil to convenient points about the plant. Where large amounts of cutting oil are used, it may be returned to the used-oil tanks or to the machines. The new oil should, however, be issued from the tool-room only upon requisition. An effort should also be made to assist the workers in determining the proper amount of oil to use on their particular machines.

In one shop, the oil supply problem was solved by equipping a truck with a suitable oil tank and pump. The truck passed through the plant once each day, delivering oil to each machine. This proved to be a very satisfactory system, both from the point of view of safety and economy. In some plants, a record is kept of the amount of oil extracted from the shavings and returned to the used-oil tank.

Middleport, N. Y. RUSSELL J. WALDO

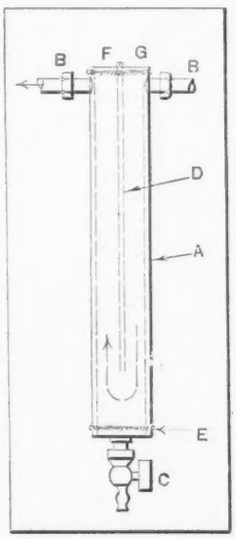


Fig. 1. Welded Water and Oil Separator

UNIQUE APPLICATION OF WELDING

Fig. 1 shows a water and oil separator for air lines. The separator was built up from a piece of 2-inch steampipe, about 2 1/2 feet long, on which were attached two fittings *B* and a gas valve *C*. In the pipe was pressed, with a rather close fit, a sheet *D*, reaching within about 4 inches of the bottom. A flange *E* for the bottom, and two half circles *F* and *G* for building the top complete the device. The welding was effected as follows:

The pipe was laid on the welding table with the sheet in place, (see Fig. 2). Two welding rods, rather thickly coated with a temporary insulating material, were welded together, end to end, and the weld also coated. This long welding rod was laid in the corner formed by the sheet and the pipe and one electrode of the welder was attached to it as shown. The current was then switched on. The welder then brought a wire into contact with the other end of the welding rod, and drew an arc between this rod and the side of the pipe. Thus started, the welding rod melted down, broke the temporary coating of insulation, and formed a perfect weld. The bottom and the two half circles at the top were then welded.

Nymegen, Holland H. C. TEN HORN

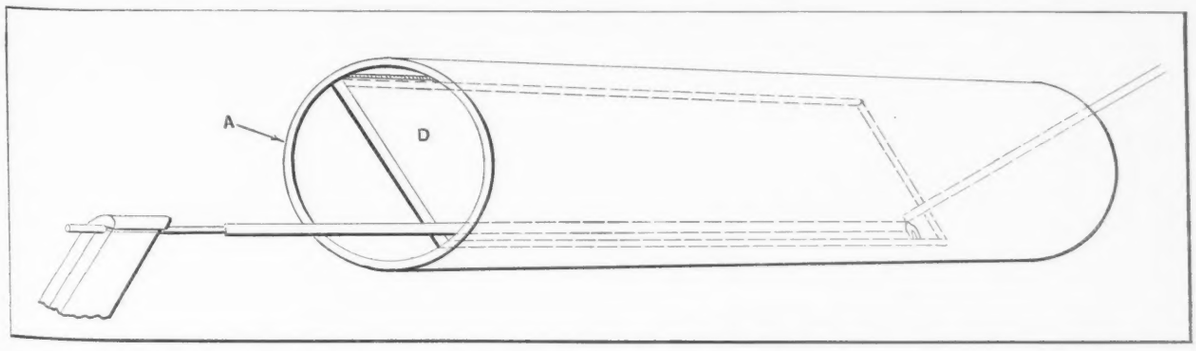
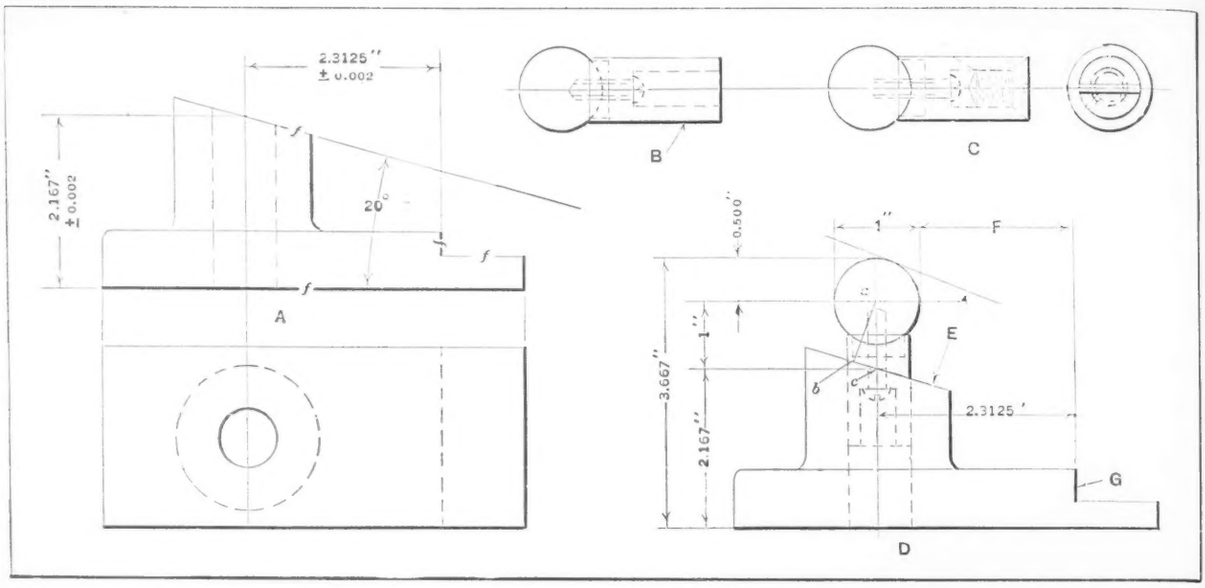


Fig. 2. Method of Welding Vane in Small Pipe



(A) Part to be Checked; (B) Holder with Ball to be Used as Indicated in View D for Checking Part A

CHECKING POSITIONS OF ANGULAR SURFACES AND HOLES

In the construction of jigs and fixtures, it is frequently necessary to check the accuracy of a part dimensioned as indicated in view *A* of the accompanying illustration. Practically all methods of checking such work require some mathematical calculations. With the method described here, however, a minimum amount of calculating is necessary.

First, a standard 1-inch steel ball is annealed, then drilled and tapped to a depth of about one-half its diameter to receive a 1/4-inch screw. This ball is next fitted to a soft steel holder *B*, which is counterbored as shown. The ball rests only on the edges of the counterbore, which holds it firmly in place and concentric with the cylindrical body of the holder.

In cases where the holder is to be subjected to continuous use, it is well to incorporate a flat-head screw, as shown at *C*. Slots are cut in the end of the body of the holder so that it can be expanded by the tapering head of the screw when the latter is turned inward. This expansion feature permits the holder to be secured in position even when the hole is slightly over size.

Now assuming that we wish to check the dimension 2.167, view *A*, we place the holder containing the ball, in the position indicated in the view at *D*. The holder is then moved up or down until the measurement from the under side of the base of the work to the top of the ball is 3.667 inches, which is the sum of the dimension to be checked plus 1 inch plus 0.500 inch, as indicated in the illustration.

Now dimension *E*, which can be easily checked with gage-blocks or a height gage, equals one-half the diameter of the ball plus *ab*. In the right-angle triangle *abc*, we have the hypotenuse *ac* equal to 1 inch and the angle at *a* equal to 20 degrees. Then, according to trigonometry, the side *ab* equals the cosine of 20 degrees, or 0.93969 inch.

The dimension 2.3125 is checked by measuring from the surface *G* to the face of the ball. The measurement *F* in this case equals 2.3125 — 0.500 = 1.8125 inches. A similar method can be used in the case of brackets having the hole drilled at an angle.

Baltimore, Md. RAYMOND H. DAUTERICH

EXPANSION DIE FOR FORMING BEAD

The expansion die shown in Fig. 2 is used for forming the bead around the rim of the cover shown in Fig. 1. The cover is made of 1/32-inch sheet brass, and is first drawn to the shape shown at *C* in a drawing die of standard design.

The fault generally found with expansion dies of ordinary design is that the expanding sections have an opening between them, when expanded, due to the fact that these sections must be made so that the die will contract sufficiently after the expanding operation to permit the work to be removed. The openings between the sections leave marks on the work, which are objectionable when a nice finish is desired. The die described in this article is so designed that the circumference of the expanded die has no opening or spaces between the expanded sections. Thus the completed cover has a smooth even bead all around.

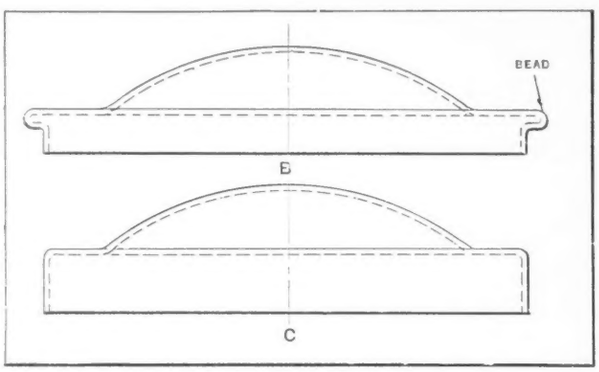


Fig. 1. (B) Cover with Bead Formed around Rim; (C) Cover Ready for Beading Operation

When the cover *C*, Fig. 1, is to be beaded, it is laid on top of the disk *D*, Fig. 2, flange down. Fig. 2 is a side view of the punch and die, and Fig. 3 is a top view of

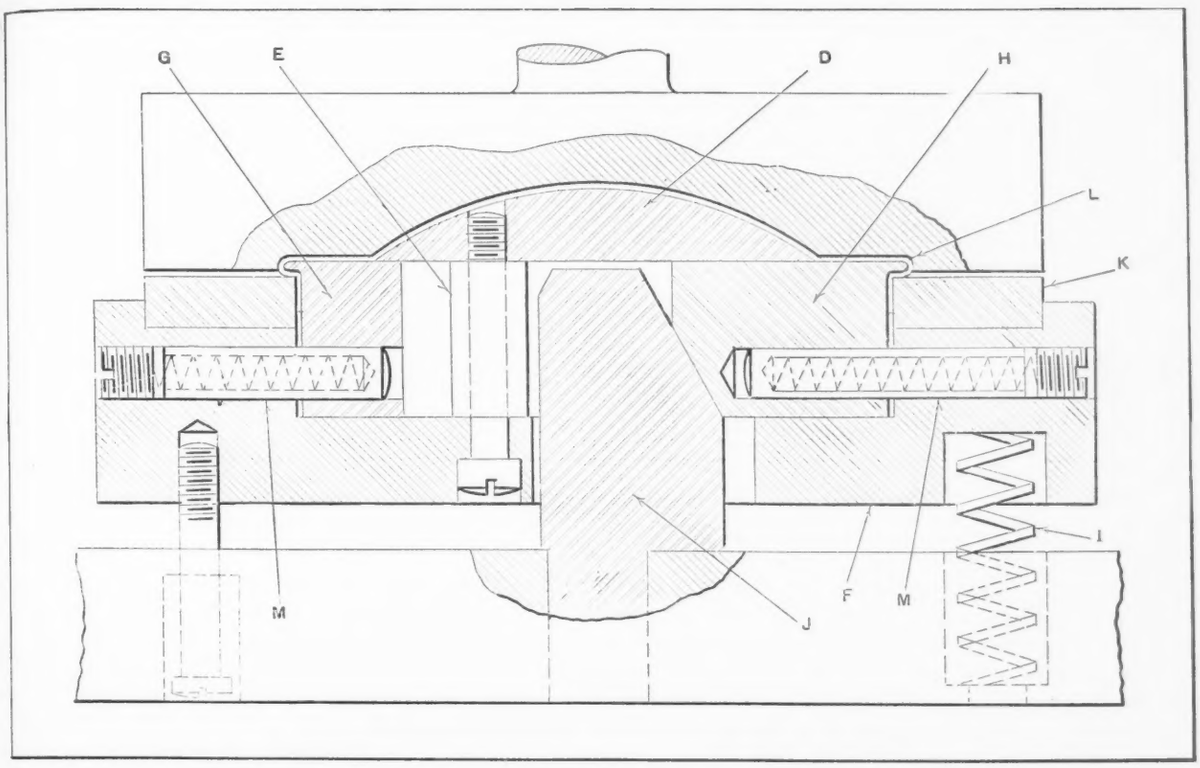


Fig. 2. Cross-sectional Side View of Cover-beading Punch and Die

the expanded die with the disk *D* removed. When the press is tripped, the downward movement of the punch is transmitted through the disk *D*, Fig. 2, and spacers *E* to the member *F*.

There are six expanding sections, three of the kind shown at *G* and three of the kind shown at *H*. As the member *F* is forced down against the tension of springs *I*, the expanding sections *H* come in contact with cam *J* and are forced outward. The sections *H* are wedge-shaped, so that in being forced out, they, in turn, force out the sections *G*. This outward movement of the expanding sections produces the bead by forcing the flange of the cover against the steel ring *K* of the die and the radius *L* on the punch.

It should be noted that the expanding sections, when moving outward, slide against the lower side of disk *D*. This makes the movement of the sections positive, and prevents any of them from sticking. They are held in place by the pins *M*, which are driven into the sections and which slide loosely in the cast-iron ring *F*. The pins are made hollow to receive springs which serve to return the sections to their normal position after the expanding operation.

Fig. 4 shows the expanding sections in their normal positions. It will be seen that, as the included angle of the cam surfaces of the wedge-shaped sections *H* is 60 degrees, these sections must travel twice as far as the sections *G*. While this may be a disadvantage in certain cases, this type of die is very satisfactory where the amount of expansion is small in relation to the diameter of the work.

Detroit, Mich. G. RUNQUIST

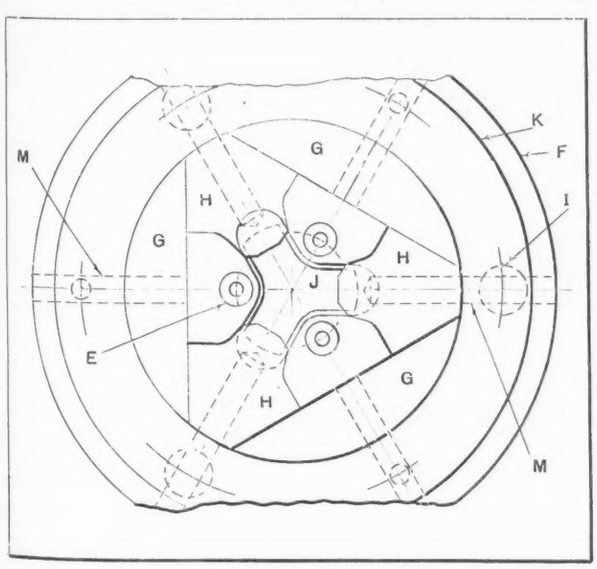


Fig. 3. Top View of the Expanded Die with Disk D (Fig. 2) Removed

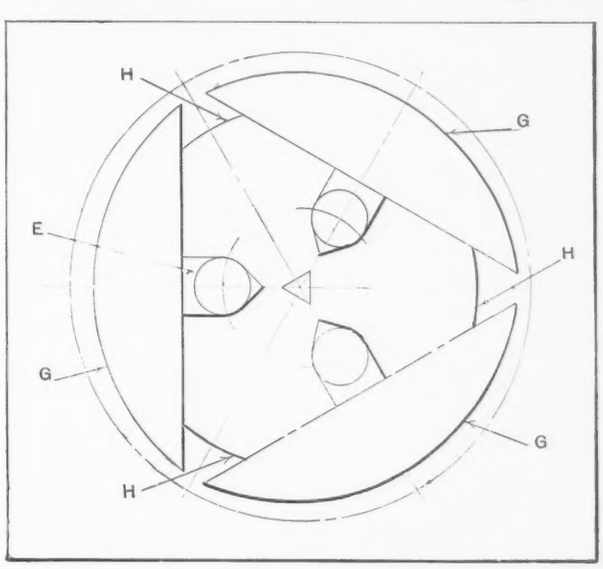


Fig. 4. Expanding Members of Die in Normal or Contracted Positions

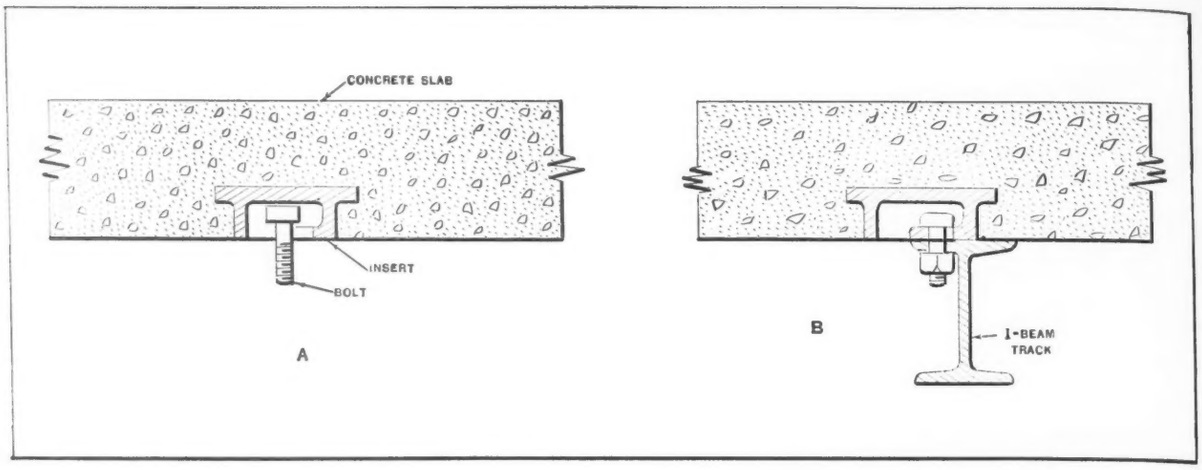


Fig. 1. (A) Insert with Bolt Head Improperly Seated; (B) Bolt Head Properly Seated in Insert

SUSPENDING LOADS FROM CONCRETE CEILINGS

In constructing concrete buildings, it is common practice to place inserts in the ceilings for the purpose of suspending lineshaft hangers, crane tracks, and various kinds of equipment used in manufacturing plants. When planning for the installation of such equipment, the question often arises as to how much weight the inserts will safely support. This is a rather difficult question to answer on account of the many variables involved.

In the case of inserts such as shown in Fig. 1, the principal factors to consider are: First, the insert size designated by the size of bolt for which the insert is designed; second, the manner in which the insert is incorporated in the concrete; third, what reinforcing, if any, is in the immediate vicinity of the insert; fourth, the manner in which the bolt is placed in the insert. All these variable factors pertain to the incorporation of the inserts in the concrete structure and its subsequent use by the mechanical maintenance department.

Not long ago one of these inserts gave way, allowing a trolley rail, hoist, and load to fall to the floor. Luckily, no one was injured. However, this accident is an indication of the prevalent hazard. In this particular case, the insert was of the 3/4-inch bolt size, and assumed to be equal in strength to this size of bolt as well as to the shearing strength of the concrete holding it in place.

In tension, the bolt should have been capable of supporting a load of 5000 pounds, and in shear, it should have been good for a load of 2000 pounds. The insert gave way, however, under a load of less than 1500 pounds. The retaining lips of the insert sheared off, leaving the body in the concrete. Since this failure, it has been the practice of the maintenance engineer to take the maximum load on a 3/4-inch insert as 1200 pounds, and that on a 5/8-inch insert, as 1000 pounds.

The illustrations show incorrect and correct methods of using inserts. At *A*, Fig. 1, is shown a common cause of failure. In this case, the bolt is not properly seated, but rests out near the ends of the retaining lips. This subjects the lips to a high stress. In all cases, the head of the bolt should be properly seated in the recess further back, as indicated in the view at *B*.

Where heavy loads are to be supported, it is sometimes necessary to use crosswise channel irons, as indicated in Fig. 2, for supporting the main I-beam. In this way, the number of inserts required to carry the load can be employed to hold the crosswise channels in place. The latter construction, of course, cuts down the head room, but is necessary where heavy loads are to be supported.

Waterloo, Iowa — C. C. HERMANN

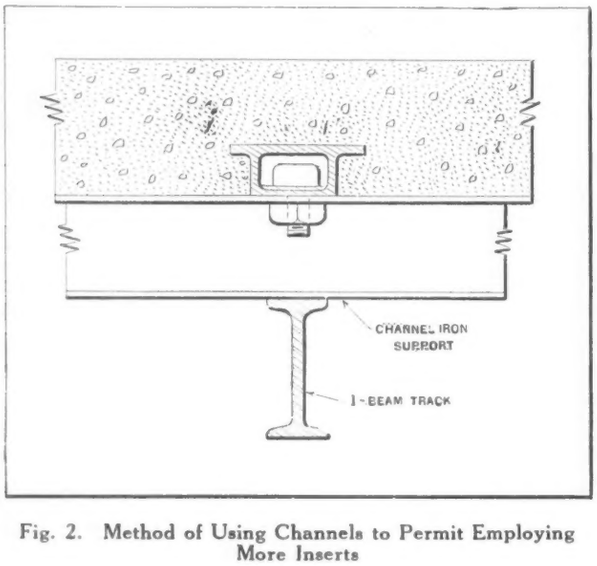
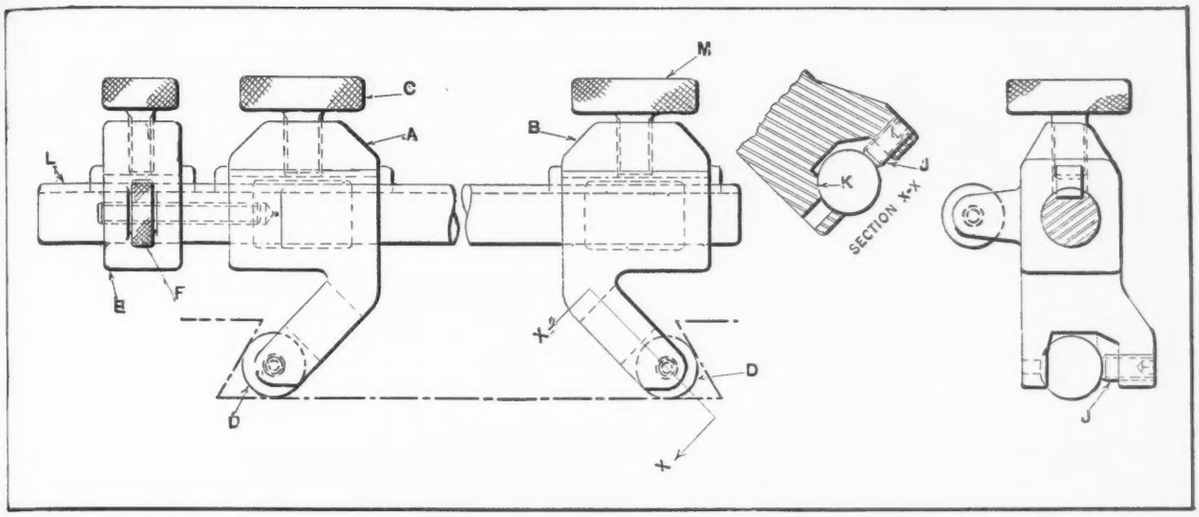


Fig. 2. Method of Using Channels to Permit Employing More Inserts

GAGE FOR DOVETAIL SLIDES

The gage shown in the accompanying illustration is used for measuring the width of dovetail slides such as indicated by the dot-and-dash lines. The same gage may also be used for the mating dovetail by removing the head *B* and securing it on the opposite side of the head *A* at *L*. The gage is set to a given dimension by means of an outside micrometer. After tightening the screw *M* in head *B*, the head *A* is given the final adjustment by turning the nut *F* in head *E* until the over-all distance, as measured over the outermost surfaces of the steel balls *D*, corresponds with the micrometer setting. The gage is then made ready for use by tightening the screw *C*.

The balls used in the gage are of the commercial type employed in ball bearings, and have the neces-



Gage for Measuring the Width of Dovetail Slides

sary hardness and accuracy. They are held rigidly in place against their seats *K* in the heads *A* and *B* by the hollow-head set-screws *J*. This method of holding the balls facilitates their removal for replacement. The seats *K* are machined with a spherical mill of a slightly smaller diameter than the balls, so that the balls are prevented from rocking or becoming loose in their seats. Should the gaging or contact points become worn, the positions of the balls may be readily changed to present new surfaces.

Fairfield, Conn. J. E. FENNO

ADJUSTABLE BORING HEAD FOR MILLING MACHINE OR DRILL PRESS

The adjustable boring head shown in the accompanying illustration, for use on a milling machine or drill press, has been satisfactorily employed for about two years in the tool-room of a manufacturing concern. It has a wide range of adjustment and supports the tool with considerable rigidity. Its only drawback is that the rake of the tool changes in relation to the cut with different adjustments, but in actual practice this slight change is found negligible.

The boring head consists of an eccentric rotatable bushing *B* in which the tool *D* is secured by the screw *C*. The body and the shank *A*, which are of one piece, are made from machine steel. The bushing *B* is preferably of hardened tool steel, and is ground to fit the hole in the body. The outer end of the bushing is knurled to give a better grip when making adjustments.

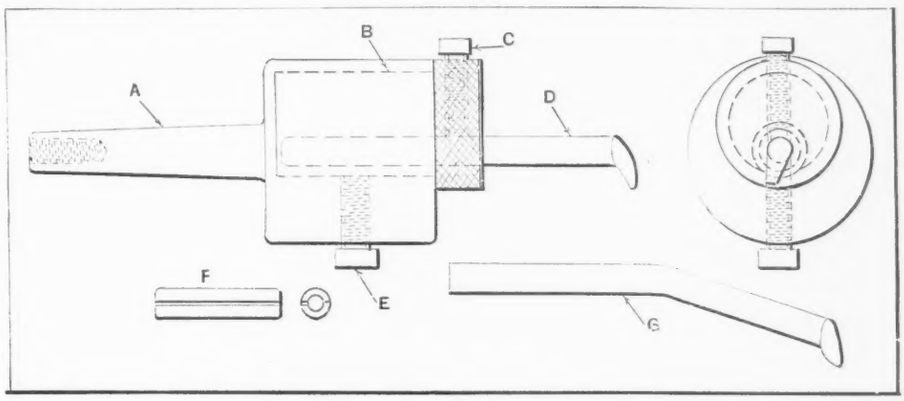
The hole in which tool *D* is held is concentric with the body when the bushing *B* is in its zero position. A hole drilled crosswise in the knurled portion of bushing *B* permits a bar to be used in making delicate adjustments. The tool is adjusted for boring different diameters by rotating the bushing *B* in the body. After being adjusted, the bushing is clamped in place by tightening the screw *E*. Although not shown in the illustration, it is advisable to insert brass plugs under the ends of the clamping screws *C* and *E* in order to prevent marring the surfaces subjected to clamping pressure. This particular boring head is made to hold tools having shanks 5/8 inch in diameter. Smaller tools may be used by employing a split bushing like the one shown at *F*. When very large holes are to be bored, an offset tool such as shown at *G* is used.

Toronto, Ont., Can. EDWARD E. CAUDLE

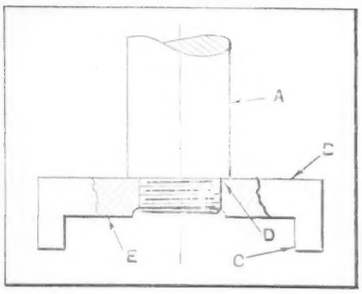
SEASONING ASSEMBLED PARTS BEFORE USE

It is unusual to assemble two pieces and then set them aside to season before finally fitting them up for use. The steel stud *A* and the cast-iron slideway *B* shown in the illustration must, however, be seasoned after the stud, which has 20 threads per inch, is screwed down tight against the shoulder. The slideway is about 5 inches long, and the stud is centrally positioned. Experiment showed that if the lower surface *E* of the slideway is scraped to a flat bearing right after screwing in the stud, the bearing would be "high" at the edges after a few days' time. In fact, even the ledges *C* showed a slight bending effect.

The safe way to manufacture this slideway is to leave a few thousandths inch on the lower surface



Adjustable Boring Head for Milling Machine or Drill Press



Assembled Parts Subjected to Seasoning before Use

and replane the surface after two or three weeks' seasoning. The same procedure should be followed in the case of the inner sides of the ledges *C*.

The illustration shows a generous countersink at *D*, which was intended to allow the stud to screw down tight against the shoulder. This is faulty practice; the stud should be necked down instead. The end thread in the hole should be chamfered just enough to prevent any burr from interfering with the proper seating of the stud. The countersink leaves a small open space, which allows the tremendous wedging action of the fine-pitch thread to increase the dishing effect on part *E*.

This is only one instance in which difficulty was experienced as a result of strains set up in the metal during the assembling operation. Other difficulties arise from strains that are inherent in the particular design or shape of the cast part. Often the manufacturer finds himself under contract to furnish work within limits that are practically impossible to maintain. In one instance, trouble was experienced with a hole located at the outer end of a cast-iron arm, 5/8 inch by 3/4 inch, which projected about 9 inches from its supporting bearing. The draftsman, of course, protected himself by specifying a plus or minus allowance of 0.002 inch. The work could easily be machined within these limits, but it would not retain its accuracy. In this case, a long period of seasoning would probably have been required in order to eliminate the distorting strains.

R. B. WILLIS

EQUALIZING MACHINING STRAINS IN COLD-ROLLED STEEL

Cold-rolled steel sometimes springs or becomes distorted after being shaped or planed, in spite of the fact that extra care is taken in clamping or holding it in place during the operation. The writer has found that this trouble can be eliminated to a large extent by removing the same amount of metal from both sides, so that the strains set up will be nearly equal on both sides of the piece. No difficulty is experienced in turning cold-rolled steel in the lathe, because an equal amount of metal is removed from all sides.

Philadelphia, Pa. CHARLES KUGLER

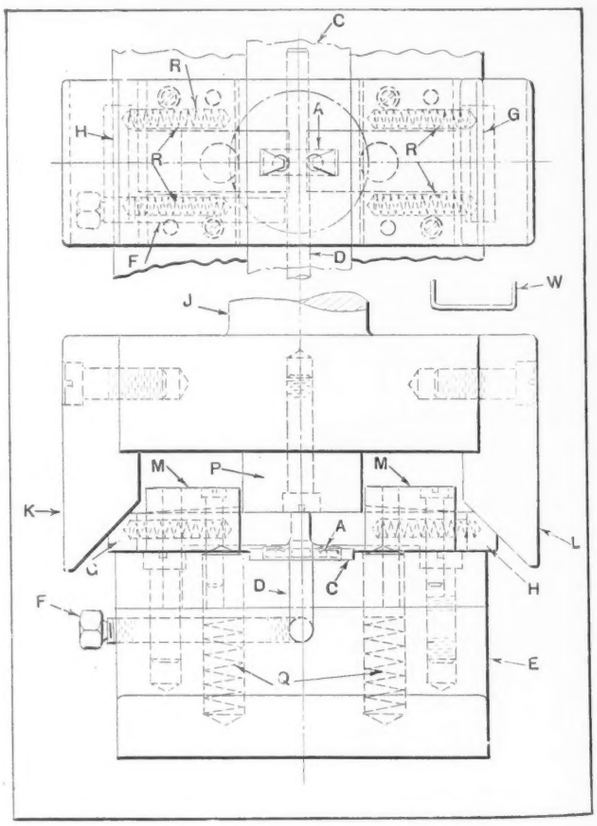
DIE FOR CLINCHING CLIP PRONGS ON CARDBOARD STRIP

In the production of novelties, many unusual operations are required. Often tools must be made at low cost which must have a fairly high production capacity. An example of this kind of work is the assembling of the clips shown at *W* in the accompanying illustration, on heavy cardboard strips like the one shown in the die at *C*. The assembling operation consists of clinching or bending over and flattening the prongs of the clips, as shown at *A*. The floating feature of the clinching slides *G* and *H* should be of interest to tool designers and diemakers.

Two holes and two slots for the prongs are first pierced in the cardboard in one operation. The functioning of the die, after the U-shaped clip *W* is pressed through the cardboard is to bend down the prongs and then embed them in the cardboard. The cardboard, with the clip in place, is located on the top of the die by means of an end-stop *D*, which is simply a piece of steel rod bent up at one end and located in the die-block *E*, where it is held in the required position by a screw *F*.

The punch-holder *J* has two blocks *K* and *L*, which have beveled surfaces at their lower ends. The beveled ends come in contact with corresponding beveled surfaces on the blocks *G* and *H* when the ram of the press descends, causing slides *G* and *H* to be forced in from the sides. This results in bending over the prongs. The slides are mounted in guide blocks *M* in such a manner that they are free to float up or down a small amount. A block *P* attached to the punch-holder strikes on the top surfaces of these slides at the end of the downward stroke of the press ram and forces the slides downward so that the prongs are embedded in the cardboard.

Springs *Q*, acting against pins located in the lower die member, serve to hold the slides *M* up while slides *G* and *H* are being forced inward by blocks *K* and *L* on the down stroke of the press ram. The four springs *R* serve to force the bending slides outward when the ram ascends. H. M.

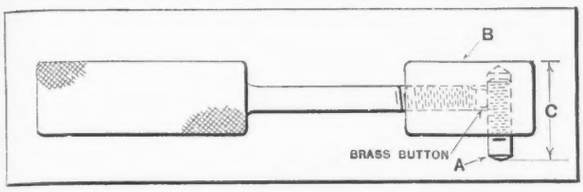


Die for Clinching Clip on Cardboard Strip

Shop and Drafting-room Kinks

GAGE FOR CHECKING HOLE DIAMETERS

The gage shown in the illustration is used for accurately checking the various hole sizes within



Adjustable Gage for Checking Different Hole Diameters

its range. The gage is adjusted by turning the screw-pin *A*, after which it is held in position by tightening the knurled handle. Adjustment of pin *A* is facilitated by flats machined on two sides of the projecting end. Member *B* is made of drill rod, and is long enough to prevent cramping in the hole. Longer pins *A* are also provided to suit larger holes.

New Britain, Conn. A. D. SEEDS

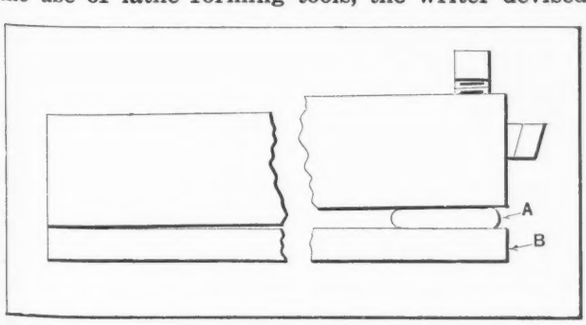
CONDITIONING VELLUM PAPER

The value of vellum paper is appreciated by all draftsmen. Its tendency to become soiled, however, together with the difficulty experienced in making erasures on its untreated surface, have in many cases restricted or limited its use. Nevertheless, vellum has helped to increase efficiency in the drafting-room by furnishing a drawing surface for pencil tracings from which blueprints can be made, and the disadvantages mentioned can be readily overcome in the following manner: Before starting a drawing on vellum paper, apply magnesia carbonate to its surface. A little of the magnesia carbonate, which can be purchased in cake form, is shaved off with a penknife on the surface of the vellum, and rubbed in. This fills the pores and hardens the surface, so that lines made with hard lead pencils can be easily erased. The surface will be kept clean even when a soft lead pencil is used.

Philadelphia, Pa. MORTON SCHWAM

PREVENTING TOOL CHATTER

To eliminate the chatter marks resulting from the use of lathe forming tools, the writer devised the method illustrated. In this instance, a standard tool-holder is used to turn half-round grooves in a shaft. The steel strip *B* is placed under the holder, and is separated from the latter at one end by the rubber *A*. This provides sufficient spring for the tool to insure a smoothly formed groove.

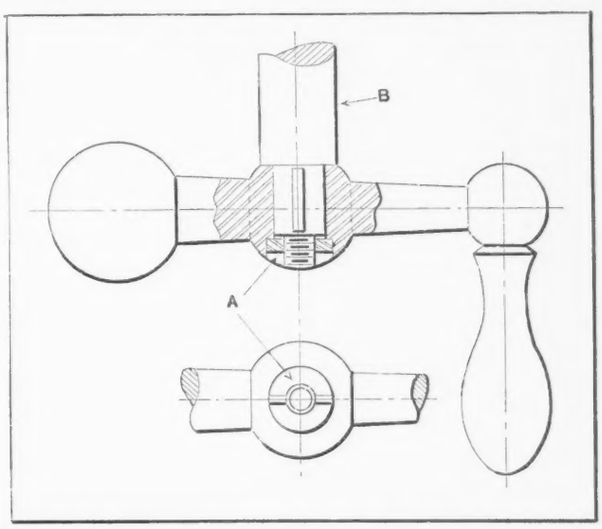


Method of Preventing Tool Chatter

Attleboro, Mass. T. E. WARD

SAFETY BALL-CRANK HANDLE

Nuts and ends of shafts projecting from machine handles are responsible for many painfully skinned knuckles and fingers, broken finger nails, and cuss words. Numerous refinements have been made in the design and construction of machinery during the last decade, but the handles that are grasped by the operator many times every day have apparently been overlooked. The conventional removable machine handle is still secured to its shaft by a projecting nut whose sharp corners cause the troubles referred to.



Ball-crank Machine Handle Secured by Fillister Nut

The accompanying illustration shows an improved method of securing a machine handle to the shaft *B* with a fillister nut *A*. The nut enters the counterbore in the center ball of the handle, thus leaving no sharp projections, yet permitting the handle to be easily removed.

Seattle, Wash. CARL E. SCHINMAN

HOLDING PARTS IN PLACE WHILE ASSEMBLING

Heavy cup grease can often be used to advantage for supporting or holding parts in place while assembling mechanical devices. For example, when it is necessary to replace the spring buffers of a press without removing the die, the loose pressure pins can be held in place until the work is completed by applying a little heavy cup grease.

S. B.

Questions and Answers

TOLERANCES FOR CENTER DISTANCES OF DOWEL-HOLES IN MATING PARTS

F. J.—Is there a method by means of which it is possible to choose the proper tolerances for the center distances of dowel-holes in mating parts, when the parts are to be jig-drilled separately on a production basis and the dowel-pins must have a close slip fit in the holes at assembly? According to the writer's experience, the effort to obtain this kind of fit has not been uniformly successful, and it would seem that an outline or chart covering the different classes of dowel fits in relation to the tolerances on the hole center distances would be greatly appreciated by many designers.

This question is submitted to the readers of MACHINERY.

OBTAINING MAXIMUM REDUCTION IN DRAWING DEEP SHELLS

L.M.R.—I would like to obtain a reliable rule for determining the radius of the rounded edge of a drawing ring or die for deep drawing operations,

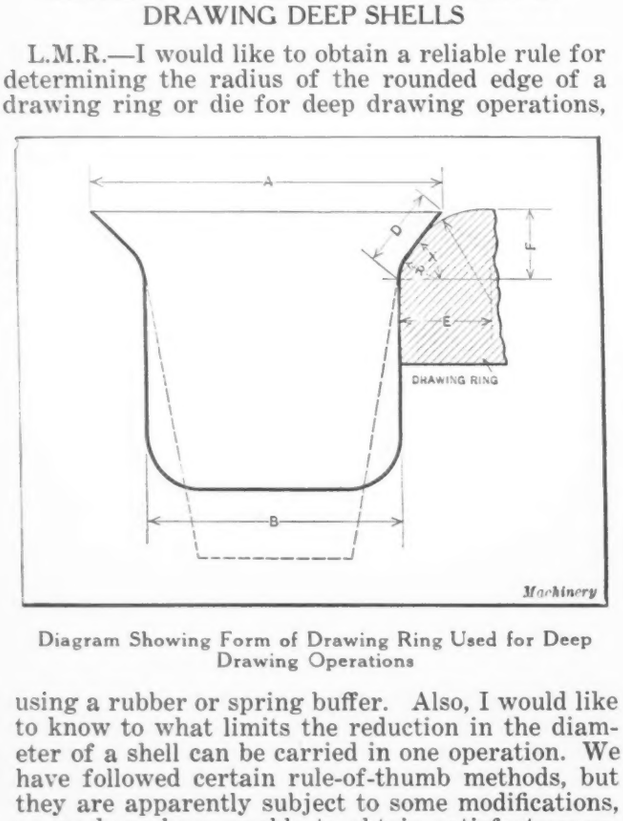


Diagram Showing Form of Drawing Ring Used for Deep Drawing Operations

using a rubber or spring buffer. Also, I would like to know to what limits the reduction in the diameter of a shell can be carried in one operation. We have followed certain rule-of-thumb methods, but they are apparently subject to some modifications, as we have been unable to obtain satisfactory results. The radius of the drawing die, denoted by R in the accompanying illustration, is made equivalent to about four times the thickness of the stock for metal less than 1/4 inch thick. The start of the rounded edge, indicated by F, is made equal to four times the thickness of the stock and is rounded back for a distance indicated by dimension E, which is taken as six times the thickness of the stock. Are these specifications in accordance with what is generally considered correct practice?

A.—The following method of determining the permissible amount of reduction in the diameter of a shell is submitted to MACHINERY'S readers for constructive criticism. Referring to the illustration, we assume that the diameter A of the flange will remain unchanged and that the flange is to be trimmed off after the drawing operations have been completed. If the angle X formed by the flange is 45 degrees, it is considered that the limit in the reduction of the shell diameter is reached when the area of the base or end is reduced to 1 1/2 times the area of the conical ring of which dimension D is the width.

If the angle X is 30 degrees, the permissible reduction in diameter is reached when the area of the end of the shell equals 1 1/3 the area of the conical flange. If the flange is at right angles to the shell, that is, if it lies flat on the drawing ring, the permissible reduction is reached when the area of the end of the shell is reduced so that it equals the area of the flange.

For a taper shell—indicated in the illustration by dotted lines—the comparison between the area of the flange and the amount of permissible reduction in diameter should be gaged by the area at the small end of the shell, the ratios being the same as for a cylindrical shell.

WHEN IS AN ORDER SENT BY MAIL PLACED?

W. S. P.—Please state the law with respect to the rights of buyer and seller in a case in which a letter is sent by a manufacturer submitting a proposal, and before receiving the acceptance (but after the letter of acceptance has been mailed by the buyer), the manufacturer mails another letter withdrawing the proposal.

Recently, I had trouble because I offered, by mail, to sell a used machine to one person, and before I received the acceptance I sold it to someone else. I immediately wrote the first person that I had sold the machine, but his letter accepting my offer reached me before my letter withdrawing the offer to sell the machine was delivered to him.

Answered by Leo T. Parker, Attorney at Law, Cincinnati, Ohio

The time when a letter is delivered to the addressee is unimportant. It is well established that a letter is presumed by the law to have reached the addressee at the instant it is dropped into a government mail box or delivered to a post office. Therefore, if a seller submits a proposal to a buyer, and the latter mails a letter accepting the proposal before the seller mails a letter withdrawing the offer, the seller is bound to make delivery. If he cannot or does not make the delivery, the prospective purchaser may sue and recover damages. Of course, if the prospective purchaser does not positively accept the original offer *in all its details*, the acceptance is not valid, and the seller may at any time withdraw the proposal.

The important point to remember is that the time of *mailing* a letter is the deciding factor.

Roller Conveyors in an Automobile Plant

A Very Efficient System for Handling and Conveying Automobile Parts, Installed in the Graham-Paige Plant at Detroit

ONE of the principal production problems in an automobile plant is the method of handling parts during manufacture. As a rule, the manufacturer strives for straight-line production as near as possible. In the Graham-Paige plant, a conveyor system has been installed to facilitate the handling of the cylinder blocks.

The first operation—finishing the top and bottom, is done on a drum type rotary milling machine, the block being lifted from the floor and placed on the machine by an air hoist. At the end of this operation the blocks are transferred to a roller conveyor, where a slight push suffices to place them in position for loading the next machine. At the extreme left of Fig. 1 is shown a block on the conveyor as it comes from the first operation. The second block has been pushed on the crossed steel bars *A* bridging the space between the conveyor and the bridge fixture *B*. The block is slid directly into the drilling fixture.

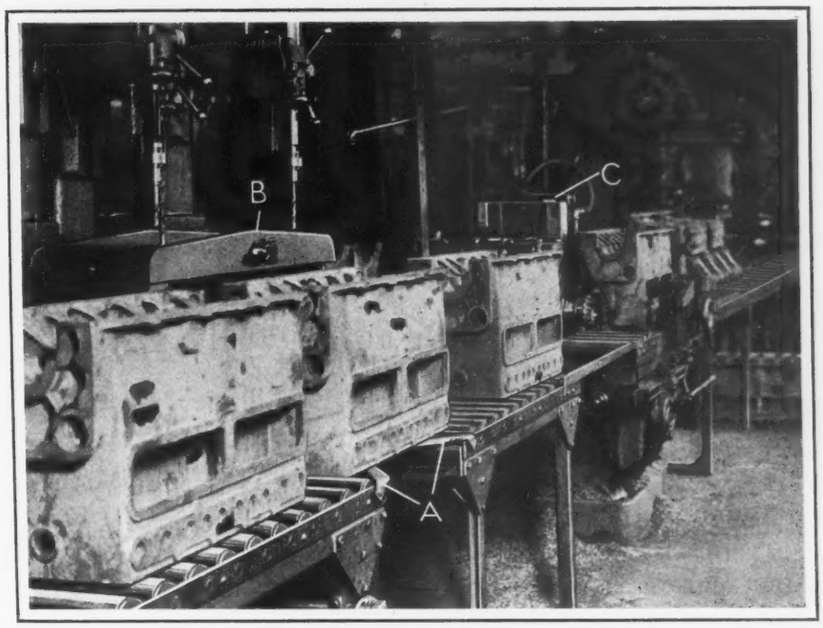


Fig. 1. Section of Conveyor, Showing Special Bridge Fixture for Drilling and Conveyor Fixture for Milling

The next operation, that of milling the water-jacket side-plate flange, is done on the machine at *C*, which is equipped with a conveyor fixture, so called because it is part of the conveyor system. This fixture has a feeding motion in the same line as the conveyor and is equipped with rollers on each side of the work-holding section to receive the blocks and deliver them to the main conveyor after milling. The block is shown in position at the end of the milling operation. The fixture rollers on the right-hand side are close enough to the last main conveyor roller to allow the block to be pushed along to the next machine. The fixture is then moved to the left until the left-hand fixture rollers are close enough to the main section so that another block can be transferred.

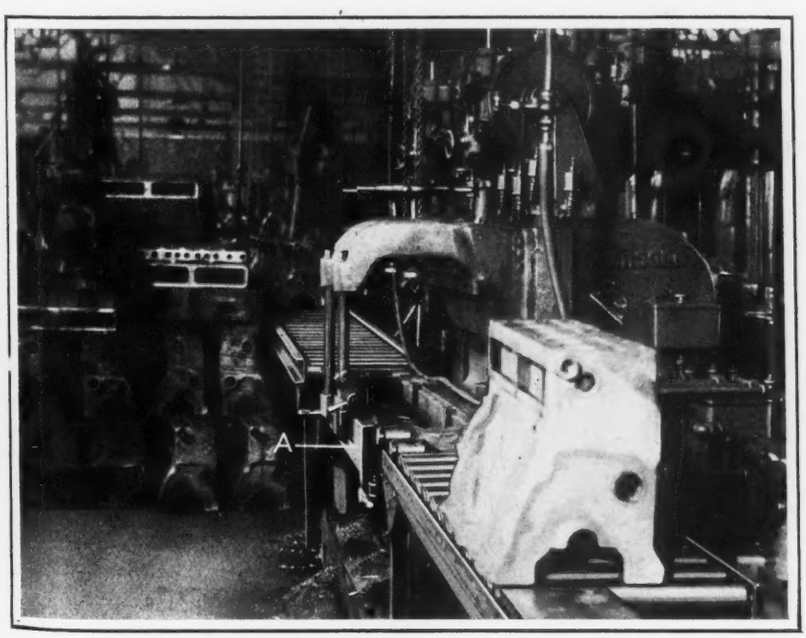


Fig. 2. Another Section of Conveyor Shown in Fig. 1, Having a Special Tunnel Fixture for Lowering the Cylinder Block to the Cutters

From this operation the blocks are moved along the main conveyor to two consecutive open-side planer type mills that mill the manifold surface and the bearing cap seats. In both these cases, the blocks are tumbled into their respective fixtures directly from the conveyor.

In Fig. 2 is shown a section of the conveyor running from a drum type milling machine in the background, and passing in front of four radial drilling machines, partly concealed by the machine in the foreground. Owing to the construction of the milling machine and the position in which the block must be set on the drilling machines, it is necessary in both cases to use hoists for loading, although the conveyor is used to bring the blocks into position in front of these machines. The blocks are pushed along to the

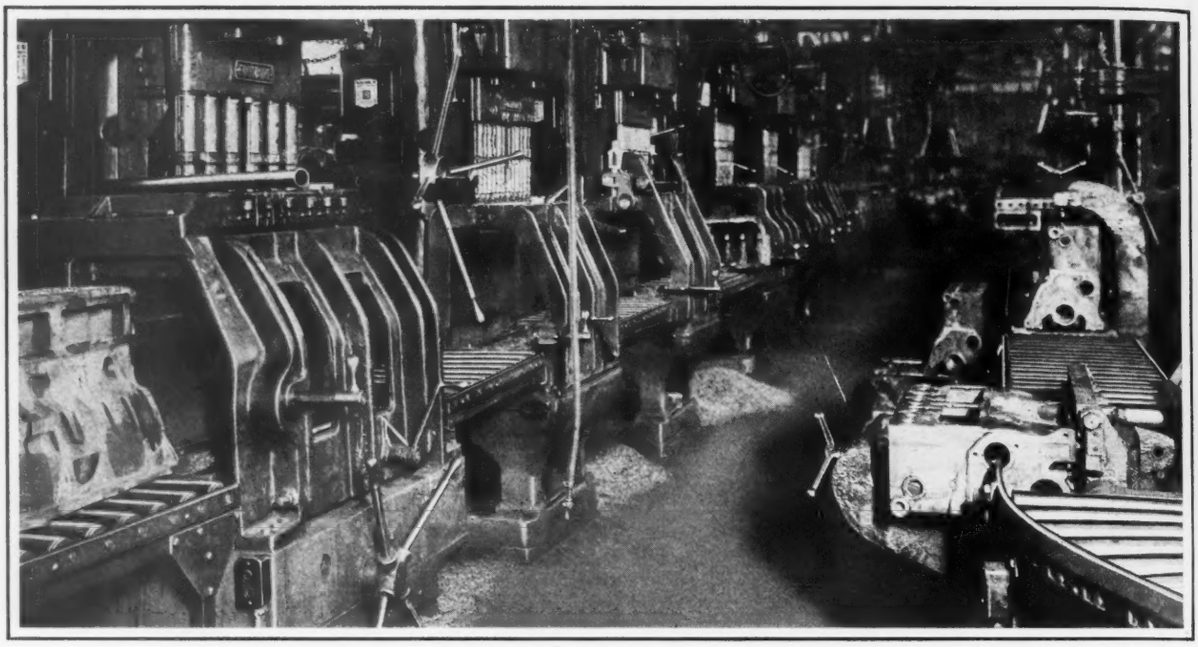


Fig. 3. Conveyor Shown at Left Passes Directly through a Large Battery of Multiple Drilling Machines and Returns through Another Line of Machines at Right

special milling machine in the foreground, which mills both sides of all main bearings and is equipped with a conveyor tunnel fixture *A*. After clamping the block in place, the fixture is fed down to the cutters and returned to a position level with the conveyor. The block is then withdrawn and pushed on the conveyor to the next machine (not shown) —a special four-spindle milling machine for milling tappet bracket, and oil regulator and gas pump pads.

When the latter operation is completed, the conveyor describes a half circle and continues in the reverse direction. In the complete line, reversal is made three times, forming four parallel stretches of equal length.

In Fig. 3 are shown two of these stretches, that on the left supplying the battery of six multiple-spindle drilling machines for boring and reaming the valve guide holes and throats. Each of these machines is equipped with a tunnel conveyor fixture that functions as part of the conveyor system. In the background are machines with special fixtures. A close-up view of one of these, a four-spindle drilling machine, is shown in Fig. 4.

A small portion of the last section of the conveyor system used in machining the blocks is shown at *A* in Fig. 5. This section serves the line of machines seen in the center, passing through a washer in the background and beyond this through fixtures similar in design to those already described, to test the water jacket for leaks and to finish-ream the valve guides and valve throats.

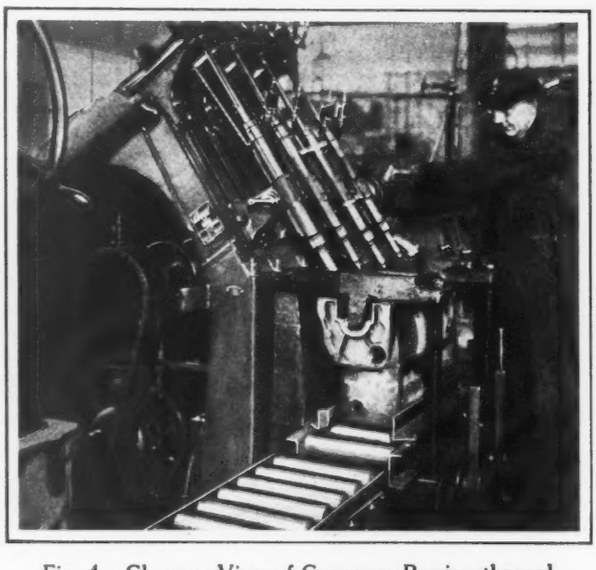


Fig. 4. Close-up View of Conveyor Passing through Special Fixture on Inclined Drilling Machine

Two parallel sections of conveyors are used for the final inspection. These are shown in Fig. 6, a bend in the second one connecting it to the production conveyor. After inspection, the blocks are picked up by an overhead chain conveyor, which is shown with two blocks suspended on the hooks, and carried to the motor assembly department, a section of which is also equipped with roller conveyors.

* * *

FLYING SCHOOL FOR AIRPLANE FACTORY EMPLOYES

An effective method of instilling a sense of responsibility into the minds of department heads and other employes has been adopted by the Mahoney-Ryan Aircraft Corporation. According to *Factory and Industrial Management*, department heads are required to take flying lessons until they have had at least one solo hour, while the other employes must have at least five flying hours with an instructor.

It has been found that many of the men who previously had shown but a slight interest in their work are now applying much greater thought and skill to their jobs. This attitude, no doubt, is brought about by the fact that each man comes face to face with the necessity of taking the utmost care in airplane construction if a high degree of safety in flying is to be maintained.

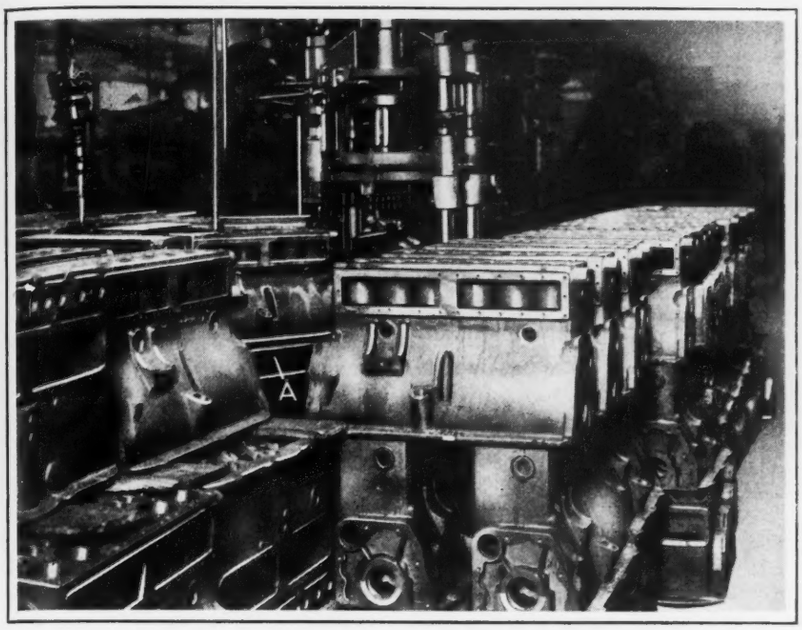


Fig. 5. Final Section of Cylinder Block Conveyor

SHOP RULES FOR APPRENTICES

The following rules, which are handed to every new apprentice in the training school of the General Electric Co. at Lynn, Mass., may prove of value in other shops where apprentices are trained:

1. Finger rings should be removed while working on machines.
2. Sleeves are to be rolled up while working on machines.
3. Wait until your machine stops before removing work from centers or chuck.
4. Do not remove or replace faceplate or chucks on the nose of a spindle while it is in motion.
5. Remove chuck wrench from chuck immediately after using.
6. Do not clean machines that are in motion.
7. Running in the shop is prohibited at all times.
8. Refer to charts for information regarding shape of screwdriver point and the placing of straps and packing.
9. Avoid striking hard metal such as files, lathe tools, etc., with a hammer or other hard or semi-hard articles, thereby avoiding injury to the eyes.
10. Do not lift, push or pull articles of any weight, such as lathe chucks, milling machine arbors, faceplates, trucks, etc., without proper assistance.
11. Do not use a file without a handle.
12. Boys having long hair must have it cut to a safe length or wear a suitable head covering.
13. Oil your machine every morning.
14. Keep your machine and bench clean. It is part of your job.
15. Do not spoil a job for want of proper information. Ask your foreman.
16. Do not mix chips or turnings of different materials, sawdust, waste paper, or other refuse.
17. Apprentices are not permitted to start any machines during the noon hour without permission from the office.
18. No apprentice is to start drilling until his set-up has been checked by a foreman, assistant foreman, or sub-foreman.
19. Do not attempt to wipe any revolving pieces (regardless of how smooth they may appear) with a piece of waste or rag.

* * *

A LIQUID-PROOF LACQUER

A material known by the trade name "Glyptal" has recently been placed on the market by the General Electric Co., Schenectady, N. Y. This material is a lacquer which is particularly suitable for sealing the joints in gas mains, for painting structural iron, oil tanks, engines, and metal parts of ships exposed to oil or vapors, fire hydrants, ship hulls, mining machinery and similar equipment that requires a sealing and insulating paint.

The new lacquers have been developed in the laboratories of the General Electric Co. and possess remarkable resistance to acids, mineral oils, alkalies, and atmospheric conditions. They also adhere tenaciously to any surface, including galvanized iron and aluminum, and form an effective protection against rust. These lacquers are available in five colors—red, blue, brown, green, and aluminum. They may be applied by brushing, spraying or dipping, and dry in about thirty minutes. Ten hours is sufficient to produce a completely hardened, smooth finish, which is not brittle and is easily cleaned.

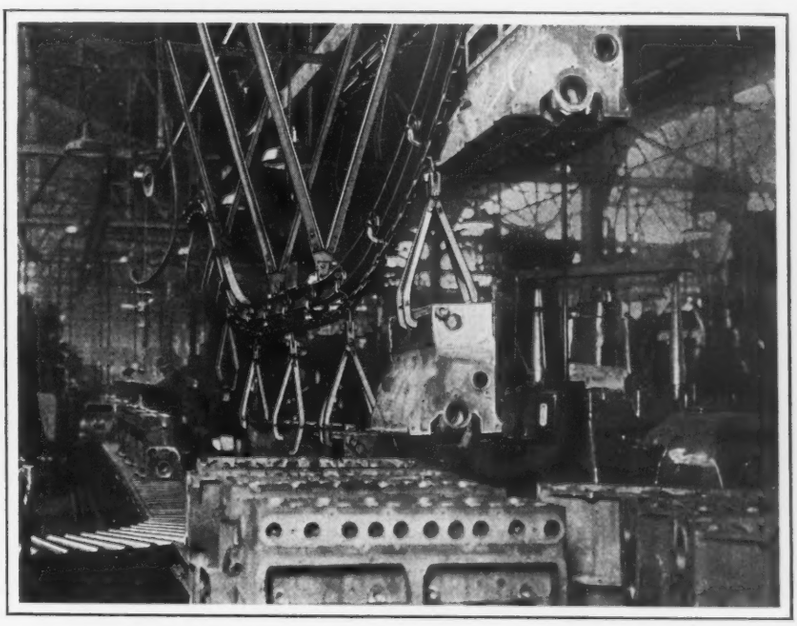


Fig. 6. Double Line Conveyor Used for Inspection, and Overhead Chain Conveyor for Transferring Blocks to Motor Department

A User Tests Tungsten-Carbide Tools

Results of Actual Shop Tests Conducted to Determine the Suitability of Tungsten Carbide for Machining Various Materials

By F. S. WALTERS

THE possibilities of cemented tungsten carbide as a cutting tool have been given wide publicity. However, some of the information published has been very confusing, and on this account, one large manufacturing concern recently conducted a series of tests to obtain accurate data concerning the behavior of tungsten carbide in machining various materials.

In these tests it was found that this alloy, in its present composition, does not meet the requirements of *all* machining practice. However, continuous research work is being conducted in the laboratories of the manufacturers and users, and it is expected that many of the difficulties, such as brittleness of the alloy, and tips that become loosened from the shank, will be overcome with more experience in the field of machining practice.

Tungsten-carbide Tools Give Best Results on Rigid Well Lubricated Machines

Since tungsten-carbide tools can be operated at speeds far in excess of high-speed steels, the design of the machine tools on which they are used must be taken into consideration. Chatter and vibration, caused by poor bearing fits in headstocks and inadequate lubrication, are factors that must be eliminated before the maximum benefits of the new alloy can be realized. Tailstocks should have as little overhang as possible, and great care must be taken to keep the dead center properly lubricated.

At higher speeds, it is also necessary to transmit more power, and care must be taken to prevent belt slippage and stalling of the machine. It is doubtful whether the old type machines have sufficient speed and rigidity to permit the maximum benefits that can be obtained through the use of this material. However, the newer type of machines can be used with much better results.

Special Wheels Required for Grinding Tungsten-carbide Tools

In grinding tungsten-carbide tools, special grinding wheels are required, and much better results will be obtained if users realize the importance of this operation. Inasmuch as the grinding of tungsten-carbide tools differs from the grinding of high-speed steel tools, specially trained operators should be assigned to the work. Roughing and finishing wheels are generally used for this operation. Much better results, however, can be obtained if the tools are hand-honed afterward.

Various Materials Successfully Turned

In general, tungsten carbide has been satisfactory as a tool material for turning Micarta, Bakelite, and other non-metallic materials. It is also satisfactory for turning cast iron, brass, or bronze. In the tests here described, it did not prove satisfactory for turning steel when it was necessary to take heavy cuts. However, it will machine steel that is too hard for high-speed steel or stellite, when only light cuts are required.

Chilled cast-iron castings, which were too hard to be machined with high-speed steel or stellite and would have had to be scrapped, were readily machined with this new alloy. A number of pertinent examples are given in the following to show the results obtained in machining cast iron, brass, bronze, copper, molded compositions, hot-rolled steel, axle steel, 3 1/2 per cent nickel steel, and marble.

Higher Production and Reduced Sharpening in Machining Brass and Bronze

On very hard brass bearings, 2 inches in diameter by 3 3/4 inches long, with a depth of cut of 5/32 inch, a feed of 0.029 inch, and a speed of 78 feet per minute, it was necessary to regrind the high-speed steel tool every 10 pieces. With a tungsten-carbide tool, the speed was increased to 136 feet per minute, and the remainder of the order, amounting to 50 pieces, was finished with the tool still in good condition.

In turning brass bearings, 1 3/4 inches in diameter by 3 1/8 inches long, with a high-speed steel tool, the depth of cut being 1/8 inch, the feed 1/32 inch, and the speed 125 revolutions per minute, it was necessary to regrind the tool every 40 bearings. By using a tungsten-carbide tool, the speed was increased to 400 revolutions per minute and it was only necessary to regrind the tool every 800 pieces.

In turning bronze bushings 2 9/16 inches in diameter by 4 1/2 inches long, with a high-speed steel tool, the depth of cut being 1/8 inch, the feed 1/32 inch, and the speed 86 revolutions per minute, it was necessary to regrind the tool every 3 pieces. With tungsten carbide, the speed was increased to 400 revolutions per minute, and the tool was reground every 200 pieces.

In a Brown & Sharpe automatic screw machine, 1500 bronze tubes, 3/4 inch long, were turned from 0.594 to 0.500 inch in diameter at 796 revolutions per minute with a high-speed steel tool. At the same speed and feed with a tungsten-carbide tool, 8000 pieces were finished. The tool was then used to machine 11,000 pieces of bronze rod, cutting them from 5/16 to 1/4 inch diameter by 1 inch long, in the same machine and at the same feed and speed. At the end of this operation, the tool did not require regrinding, and was used in another test, whereas the high-speed steel tool required regrinding every 800 pieces. The total number of these pieces that could be turned with the tungsten-carbide tool is

unknown, because the quantity on order was insufficient to obtain a life test.

In turning copper commutators, conflicting results were obtained. For example, commutators were turned successfully in one department, and unsatisfactorily in another department. These results were probably due to different conditions in the set-ups, shape of the tools, and the finish required.

Tool Stands up Well under Intermittent Cuts on Cast Iron at High Speed

In machining cast-iron spiders, 14 inches in diameter by 48 inches long, with a tungsten-carbide tool, a depth of cut of 1/4 inch, and a feed of 1/16 inch, 6619 cubic inches of metal was removed at 100 feet per minute. The tool was then still in fine condition, and the cutting speed was successively increased to 150, 235, 267, and 275 feet per minute, 140 cubic inches of metal being removed at each of these speeds. Finally, the speed was stepped up to 400 feet per minute and 122 cubic inches of material removed.

The spider machined had four equally spaced ribs, 4 inches wide, running the total length of the piece. At a speed of 400 feet per minute, the tool received 660 blows per minute from the rough sandy sides of these ribs.

Ten tools of various brands, including cast alloys, were checked in this operation in comparison with a tungsten-carbide tool. All these tools were of the tipped type and were used until they chipped, broke, or burned. The tungsten-carbide tool cut more material than the total amount cut by the other ten tools, and after this demonstration, the tungsten-carbide tool was still in good condition.

Marked Lasting Qualities of Tungsten-carbide Tools

In turning down 3/4-inch long hot-rolled steel bushings from 0.500 inch to 0.400 inch diameter on a Brown & Sharpe automatic screw machine, a high-speed steel tool required regrinding every two days. A tungsten-carbide tool was used and cut for ten days.

Tests made with tungsten-carbide tools in rough-turning steel axle-shafts, both annealed and heat-treated, have shown that the material in its present composition is unsuited for taking heavy cuts. The constant friction of the chip wears a groove in the lip of the tool, and after the groove becomes deep, the cutting edge crumbles and breaks away.

In machining 3 1/2 per cent nickel steel of No. 275 Brinell hardness, with a feed of 1/18 inch, a depth of cut of 3/8 inch, and a speed of 65 surface feet per minute, the best grade of high-speed steel failed after 3 minutes. A tungsten-carbide tool, after turning 10 minutes, showed no signs of wear.

Cutting Speed Quadrupled on Bakelite and Materials of Similar Composition

Diamonds have been replaced by tungsten-carbide tools for machining Micarta, Bakelite, and other molded composition materials in this plant. It has been found that a heavier feed can be used with a tungsten-carbide tool than with a diamond. The cost of a diamond tool is $125, as against $8 for a tungsten-carbide tool. The tungsten-carbide tip is held firmer than a diamond, and there is not the same likelihood of loss due to the diamond becoming loosened. Another advantage possessed by a tungsten-carbide tool, as compared with a diamond, is that a cutting face can be readily obtained and regrinding of the tool easily accomplished.

On a difficult job consisting of cutting a groove 1/16 inch wide by 1/16 inch deep in the inside of a small molded-composition meter case at a speed of 60 feet per minute, a high-speed tool had to be reground every piece. By using a tungsten-carbide tool, the surface speed was increased to 250 feet per minute. After finishing 150 pieces, the tungsten-carbide tool was in perfect condition.

Tungsten Carbide Resists Abrasive Action of Marble

The ability of tungsten carbide to withstand abrasive action was clearly demonstrated in turning a 2-inch square piece of marble 12 inches long. At 100 feet per minute, a high-speed steel tool turned off the corners to a depth of 1/8 inch for a length of 1/2 inch. With a tungsten-carbide tool, the speed was increased to 200 feet per minute and finally to 400 feet, the marble being turned to 1 3/4 inches round, using a 1/32 inch feed. The tool showed no signs of wear.

Tungsten carbide will play an important part in machining various materials, and as improvements in the alloy take place and machine tools are adapted to it, greater results may be expected.

* * *

THE A. S. M. E. IRON AND STEEL DIVISION TO MEET IN CLEVELAND

The Iron and Steel Division of the American Society of Mechanical Engineers will hold its annual fall meeting in Cleveland, Ohio, during the week beginning September 9, in conjunction with the National Metal Congress and the National Metal Exposition to be held in the Public Auditorium at that time. The papers to be presented at the Iron and Steel Division meeting deal with automatic arc-welding of thin sheets, welding of boiler tubes, non-destructive tests of welds, alloy steels in iron and steel mill equipment, blast furnace design and practice, ore handling, oil-electric locomotives in steel mill transportation, drives for mill table rollers, heat distribution in combustion furnaces, advantages of producer gas as a fuel, and powdered coal cupolas.

* * *

AN ENTIRELY GAS-WELDED BUILDING

A building 75 by 260 feet and 42 feet 5 inches to the lower chord of trusses, built for the Union Carbide Co's. new research laboratory at Niagara Falls, N. Y., is entirely gas-welded. The building has thirteen bays, and a full-span, 10-ton traveling crane will run the entire length. Two hundred ninety-seven tons of structural steel are required, and the total amount of welding is as follows: 2500 feet of 3/8-inch fillet welds, 335 feet of 5/8-inch fillet welds, 70 feet of 3/8-inch open butt welds, and 35 feet of 5/8-inch single vee butt welds. This building is the first of a series of oxy-acetylene welded buildings in contemplation for construction under the direction of the Linde Air Products Co.

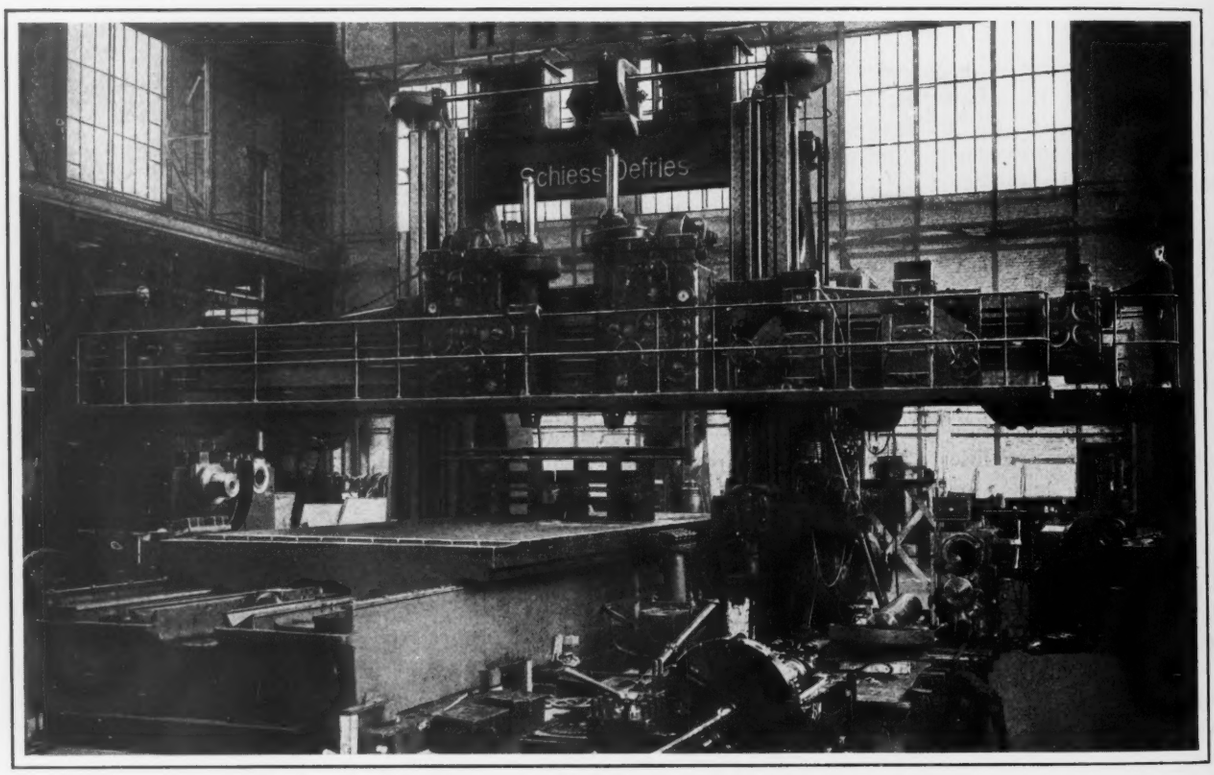
Planing and Milling Machine of Huge Size

An Electrically Controlled Motor-operated Combination Planing and Milling Machine Built for Machining Large Turbine Cases and Similar Work

By S. WEIL, Chief Engineer, Schiess-Defries, A. G., Dusseldorf, Germany

THE exceptionally large combination planing and milling machine shown in the accompanying illustration has five tool-heads arranged to facilitate the machining of large turbine casings without resetting the work. Two milling heads and two planing heads are mounted on the cross-rail. The remaining head, which is used for planing, is mounted on the right-hand upright.

This machine is electrically controlled, and was built by Schiess-Defries, A. G., Dusseldorf, Germany, for Brown Boveri & Co., Baden, Switzerland, who supplied the complete electrical equipment. The clear height below the milling heads is a little over 12 feet, and the total height of the machine is 27 feet. A floor space of 62 by 50 feet is required.



A Very Large Combined Planing and Milling Machine of German Design, Having a Clear Height Under the Milling Heads of 12 Feet and Occupying a Floor Space of 50 by 62 Feet

The massive table is over 31 feet long and more than 12 feet in width. It is carried on four ways and driven by a 70- to 130-horsepower direct-current, variable-speed motor having a range of speeds from 350 to 1400 revolutions per minute. Cutting speeds range from 23 to 59 feet per minute, and rapid return speeds of from 59 to 99 feet per minute are available.

Separate and individual motors of small size furnish the feeding and rapid traversing movements of the three planing heads. Twenty different feeds are provided ranging from 0.02 to 4 inches for the horizontal feed, and from 0.01 to 2 inches for the vertical and inclined feeding movements of the planing heads on the cross-rail.

The feeds for the planing head on the upright may be varied from 0.016 to 3.2 inches for the vertical feed and from 0.008 to 1.7 inches, for the horizontal feed. The motors that govern the feeding movements are automatically started at a point near the end of the return stroke and automatically stop at the completion of the feeding movements. Small electric motors are also provided for raising the tools out of contact with the work during the return stroke.

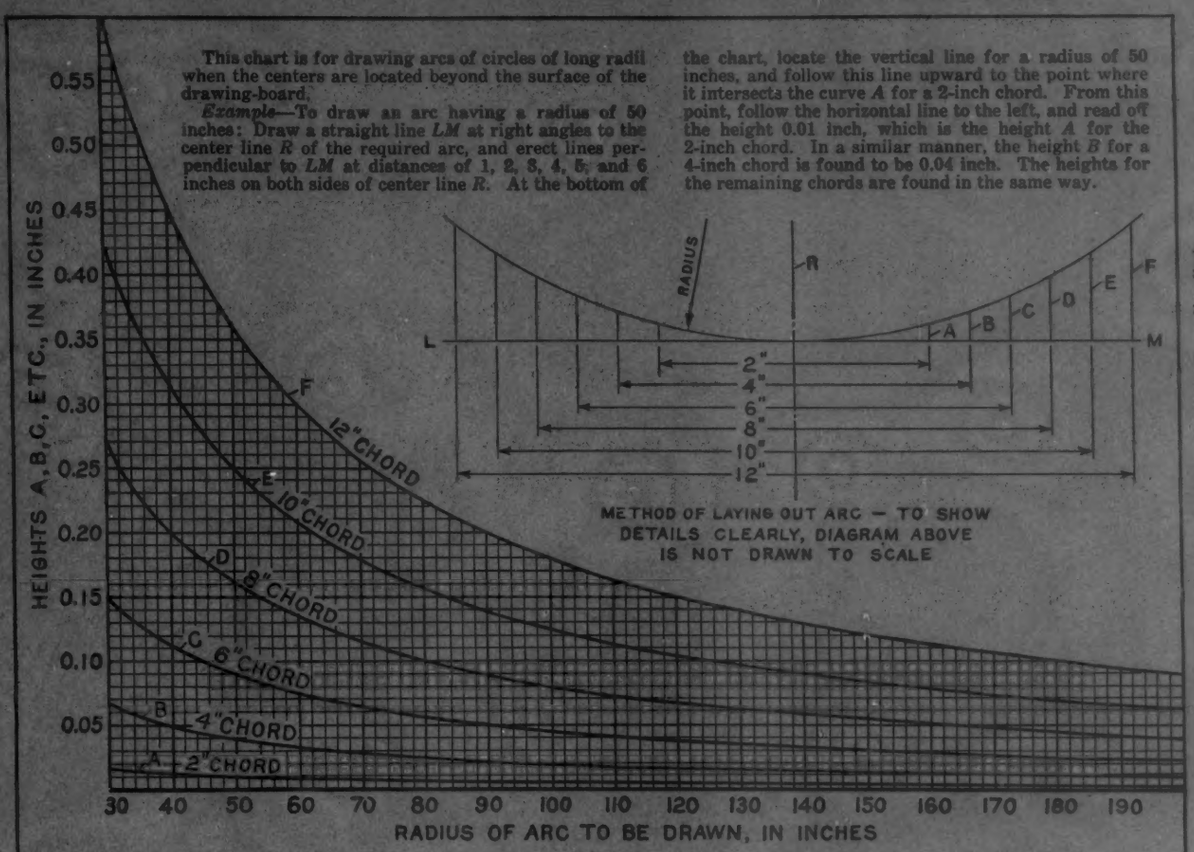
The two milling heads have spindles 7 inches in diameter. Each spindle is driven by a 20-horsepower motor having a variable speed ranging from 780 to 1560 revolutions per minute, while the cutter speed can be adjusted between 5 and 125 revolutions per minute. The feed of the milling heads along the cross-rail ranges from 5/16 inch to 11 inches per minute. The vertical feed may be hand- or power-operated. Multiple-tool cutter-heads up to 23 5/8 inches in diameter can be employed. The table is provided with an automatic feed for longitudinal milling, which is operated by a lead-screw mounted in the bed plate.

MACHINERY'S DATA SHEETS 159 and 160

CHART FOR LAYING OUT ARCS OF CIRCLES HAVING LARGE RADII

This chart is for drawing arcs of circles of long radii when the centers are located beyond the surface of the drawing-board.

Example—To draw an arc having a radius of 50 inches: Draw a straight line *LM* at right angles to the center line *R* of the required arc, and erect lines perpendicular to *LM* at distances of 1, 2, 3, 4, 5, and 6 inches on both sides of center line *R*. At the bottom of the chart, locate the vertical line for a radius of 50 inches, and follow this line upward to the point where it intersects the curve *A* for a 2-inch chord. From this point, follow the horizontal line to the left, and read off the height 0.01 inch, which is the height *A* for the 2-inch chord. In a similar manner, the height *B* for a 4-inch chord is found to be 0.04 inch. The heights for the remaining chords are found in the same way.



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MACHINERY'S Data Sheet No. 159, New Series, August, 1929 Contributed by Walter F. Hawley

REVOLUTIONS PER MINUTE FOR VARIOUS CUTTING SPEEDS—LARGE DIAMETERS*

Diameter, Inches	Cutting Speed, Feet per Minute																
	10	15	20	25	30	35	40	45	50	55	60	70	80	90	100	125	150
	Revolutions per Minute																
8	4.8	7.2	9.5	11.9	14.3	16.7	19.1	21.5	23.9	26.3	28.7	33.4	38.2	43.0	47.8	59.8	71.7
8 1/2	4.5	6.7	9.0	11.2	13.5	15.7	18.0	20.2	22.5	24.7	27.0	31.4	36.0	40.4	45.0	56.2	67.4
9	4.2	6.4	8.5	10.6	12.7	14.9	17.0	19.1	21.2	23.3	25.5	29.7	33.9	38.2	42.4	53.0	63.7
9 1/2	4.0	6.0	8.0	10.0	12.0	14.1	16.1	18.1	20.1	22.1	24.1	28.1	32.2	36.2	40.2	50.2	60.4
10	3.8	5.7	7.6	9.5	11.4	13.4	15.3	17.2	19.1	21.0	22.9	26.7	30.5	34.4	38.2	47.7	57.2
11	3.5	5.2	7.0	8.7	10.4	12.2	13.9	15.6	17.4	19.1	20.8	24.3	27.8	31.3	34.8	43.5	52.2
12	3.2	4.8	6.4	8.0	9.6	11.2	12.7	14.3	15.9	17.5	19.1	22.2	25.4	28.7	31.8	39.8	47.7
13	2.9	4.4	5.9	7.3	8.8	10.3	11.7	13.2	14.7	16.2	17.6	20.6	23.5	26.4	29.4	36.7	44.1
14	2.7	4.1	5.5	6.8	8.2	9.6	10.9	12.3	13.6	15.0	16.4	19.1	21.8	24.6	27.3	34.2	41.0
15	2.5	3.8	5.1	6.4	7.6	8.9	10.2	11.5	12.7	14.0	15.3	17.8	20.4	22.9	25.5	31.9	38.2
16	2.4	3.6	4.8	6.0	7.2	8.4	9.5	10.7	11.9	13.1	14.3	16.7	19.1	21.5	23.9	29.9	35.8
17	2.2	3.3	4.5	5.6	6.7	7.9	9.0	10.1	11.2	12.3	13.5	15.7	18.0	20.2	22.5	28.1	33.7
18	2.1	3.2	4.2	5.3	6.4	7.4	8.5	9.5	10.6	11.6	12.7	14.8	17.0	19.1	21.2	26.5	31.8
19	2.0	3.0	4.0	5.0	6.0	7.0	8.0	9.0	10.0	11.0	12.0	14.0	16.1	18.1	20.1	25.1	30.2
20	1.9	2.9	3.8	4.8	5.7	6.7	7.6	8.6	9.5	10.5	11.4	13.3	15.3	17.2	19.1	23.9	28.6
22	1.7	2.6	3.5	4.3	5.2	6.1	6.9	7.8	8.7	9.6	10.4	12.1	13.9	15.6	17.4	21.7	26.1
24	1.6	2.4	3.2	4.0	4.8	5.6	6.4	7.2	8.0	8.8	9.6	11.1	12.7	14.3	15.9	19.9	23.9
26	1.5	2.2	2.9	3.7	4.4	5.1	5.9	6.6	7.3	8.1	8.8	10.3	11.7	13.2	14.7	18.4	22.0
28	1.4	2.0	2.7	3.4	4.1	4.8	5.5	6.1	6.8	7.5	8.2	9.6	10 9	12.3	13.7	17.1	20.5
30	1.3	1.9	2.5	3.2	3.8	4.5	5.1	5.7	6.4	7.0	7.6	8.9	10.2	11.5	12.7	15.9	19.1
32	1.2	1.8	2.4	3.0	3.6	4.2	4.8	5.4	6.0	6.6	7.2	8.4	9.5	10.7	11.9	14.9	17.9
34	1.1	1.7	2.2	2.8	3.4	3.9	4.5	5.0	5.6	6.2	6.7	7.9	9.0	10.1	11.3	14.0	16.8
36	1.0	1.6	2.1	2.6	3.2	3.7	4.2	4.8	5.3	5.8	6.4	7.4	8.5	9.6	10.6	13.3	15.9
38	1.0	1.5	2.0	2.5	3.0	3.5	4.0	4.5	5 0	5 5	6.0	7.0	8.0	9.1	10.0	12.6	15.1
40	0.9	1.4	1.9	2.4	2.9	3.3	3.8	4 3	4.8	5.2	5 7	6.7	7.6	8 6	9.5	11.9	14.3

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*Tables for diameters from 1/4 to 8 inches are given in the Seventh Revised Edition of MACHINERY'S HANDBOOK, pages 864 and 865.

MACHINERY'S Data Sheet No. 160, New Series, August, 1929

Bending Die for Radio Tube Wires

Construction of a Combination Die for Bending and Trimming the Wires in the Glass Bases of Radio Tubes

By JOSEPH S. PECKER, Consulting Engineer, Philadelphia, Pa.

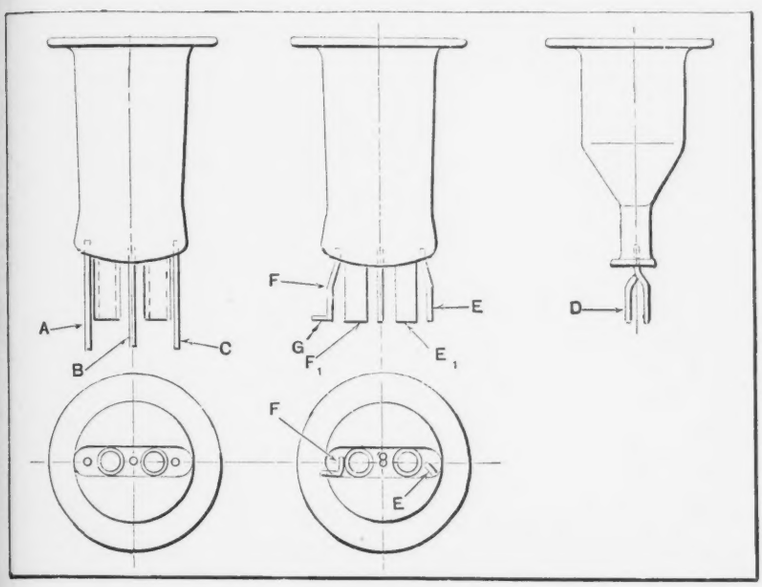


Fig. 1. Glass Base of Radio Tube, Showing Wire Elements before and after Bending

THE unique type of die described in the following is used in forming and trimming the wire element prongs of radio tubes. In the view to the left, Fig. 1, is shown the glass base of one of the tubes with the three element wires, *A*, *B*, and *C*, in place, as they appear when the assembly comes from the mold in which the glass base is formed. The wires vary in length and are required to be trimmed to exact dimensions. The center wire *B* remains in the same vertical plane, but is bent upward as shown at *D*.

The wire *C* is given a double formation, as shown at *E* in the side and end views. The wire *A* is formed in two planes, as shown at *F*, and the end is then turned at right angles to the tube, as indicated at *G*. Several forming dies were originally designed to perform these bending operations. However, one die was finally developed which performed both the forming and the trimming in one operation.

In Fig. 2 is shown a plan view of the lower die, which performs the bending and trimming operations. The view at the top of Fig. 3 is a cross-section on the line *B–B* through the front elevation of the upper die. A cross-section view on the line *C–C*, Fig. 3, is shown in Fig. 4. The view at *A*, Fig. 5, shows a partial assembly of a unit of the upper die. The views *B*, *C*, and *D* show additional details of the various parts of the die.

Prong- or Wire-bending Operation

In performing the bending and trimming operations, the glass tube is placed in the gage *H*, as indicated in Fig. 4. The front end of the tube is located against the face *J* of the stop, shown in view *E*, Fig. 5. The unit shown at *A* is free to float in the upper die member, and is retained in its outermost position by means of the spring *K*, Fig. 3, and by set-screw *L*, which slides in the slot *M* shown in view *A*, Fig. 5.

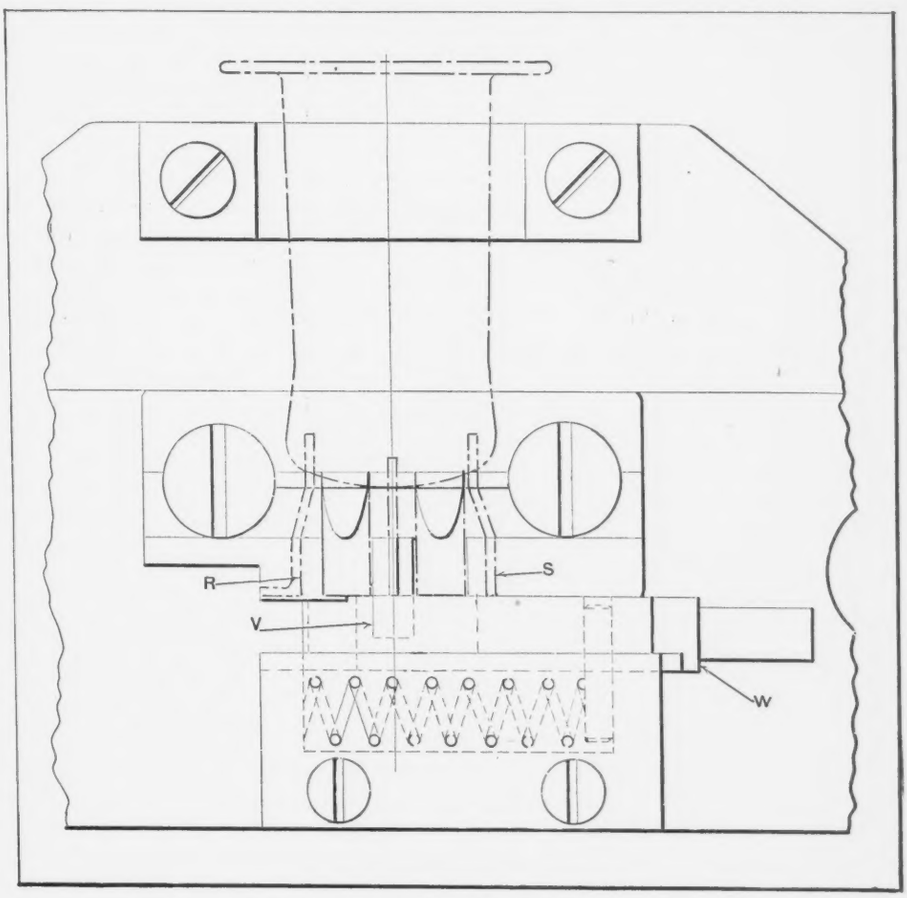


Fig. 2. Cross-section A-A of Fig. 3, Showing Die in which Radio Tube Wires are Bent

Secured in the upper die is the shear blade *N*, Fig. 3, and the double shear blade *O*. As the upper die member descends, the forming blades *P* and *Q* pass between the glass tubes F_1 and E_1, and the prongs *F* and *E*, bending the latter to the shapes indicated at *R* and *S*, Fig. 2, and at *T*, Fig. 4.

Action of Trimming Punches

The forming tool *U*, shown in view *A*, Fig. 5, comes into position after the bending dies have operated, and acts as the die for the finger-punch shown in view *B*, Fig. 5, which receives an upward motion through the engagement of the projection *V* with the slide *W*, Fig. 2. The necessary movement is imparted to slide *W* by the finger-punch *X*, Fig. 3, which is fastened to the upper die member.

When the forming operation is completed, the continued downward movement of the punch member causes the spring *K*, Fig. 3, to be compressed and the shear blades *N* and *O* to descend and trim the ends of the wires. The slide *W* serves as a former for bending the wire *F*, Fig. 1, around the lower forming die, as indicated at *R*, Fig. 2. The

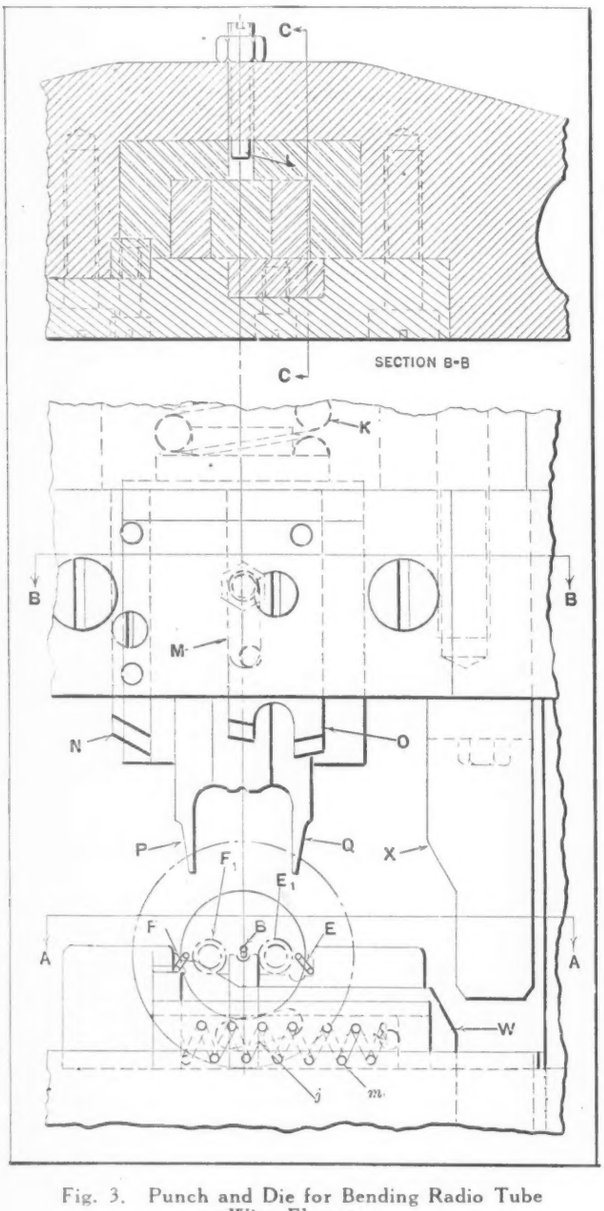


Fig. 3. Punch and Die for Bending Radio Tube Wire Elements

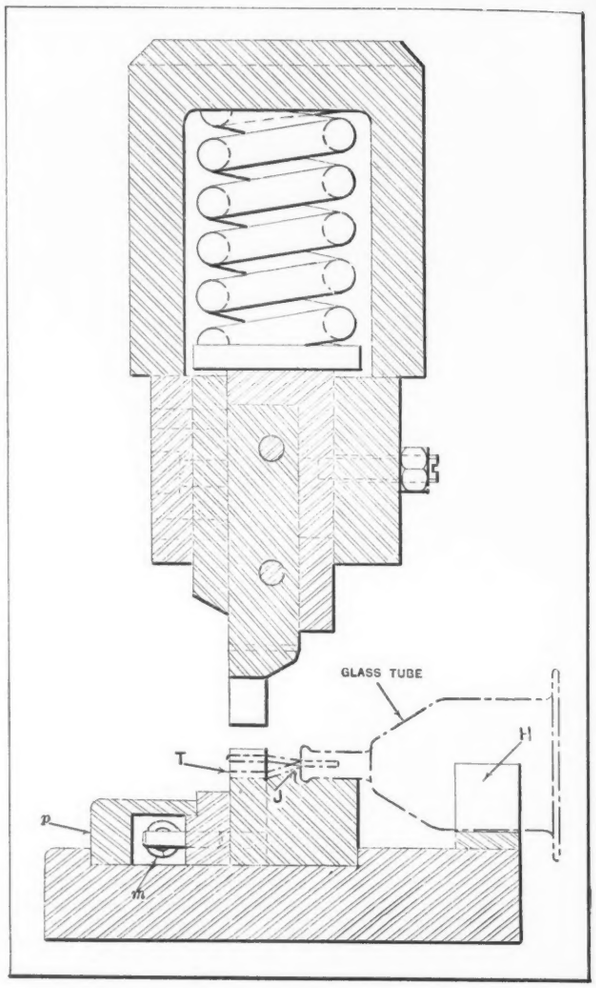


Fig. 4. Cross-section C-C, Fig. 3

recess in the forming die in which the end of the wire is formed may be seen at *I* in the view *D*, Fig. 5.

When the cam surface of finger *X*, Fig. 3, has reached its "dwell" surface, the shearing action takes place, and the bent wire *E*, Fig. 1, is trimmed on the face *Y*, view *D*, Fig. 5, while the wire *B*, Fig. 1, is trimmed on the face *Z*, Fig. 5, and the wire *A*, Fig. 1, on the left-hand face of the forming member *T*, Fig. 5.

The pocket *a* in the lower die, view *D*, is provided to receive the finger-punch shown in view *B*. The pockets *b* and *c* are provided to permit fingers *P* and *Q* (view *A*) to enter the cutting dies. The recesses *d* and *e* are to receive the glass tubes. The cut-out *f* is provided to receive the bead on the glass tube. The walls *g* and *h* are for the forming of the wires.

The view *C*, Fig. 5, which shows the slide *W*, Fig. 3, requires hardly any further explanation, except that *j* is the cam slot that operates the punch shown in view *B*, Fig. 5. At *k* is the forming nose for the wire *A*, Fig. 1. The pin *L*, view *C*, Fig. 5, reacts against the spring *m*, Figs. 3 and 4. Spring *m* is contained within the casing *p*, Fig. 4. In designing the die described, provision was made for replacing all parts subject to wear or breakage. Care was also taken to design the die members in such a manner that the trimmed ends of the wire could be readily removed.

A NEW TUNGSTEN-CARBIDE TOOL

The Haynes Stellite Co., 30 E. 42nd St., New York City, has announced that a new cutting tool material of the tungsten-carbide type will soon be placed on the market under the name "Haystellite." This alloy was introduced a short time ago for use as a diamond substitute on oil-well bits and for drawing dies, and has been extremely successful for these applications. A modification of the original alloy has been found to be valuable as a cutting metal, and laboratory and shop tests, the latter in a few of the largest production shops in the country, have been in progress for several months.

"Haystellite" is different from most of the tungsten-carbide tools at present on the market in that it is a cast alloy; however, the new material is not stellite, but differs radically from the latter in composition.

The alloy, in so far as cutting tools are concerned, is in the final development stage; the final tests and the manufacture of an initial stock of standard tools will be completed so that tools may be placed on the market some time during the latter part of this year. At the present time, the manufacturer is not in a position to furnish sample tools, but expects to be able to do so in the near future.

* * *

An air-operated device for shifting locomotives has been put into use in the Chicago, Burlington & Quincy Railroad Co's. shops. Previously a switching engine was used for this purpose, but now, with the aid of an overhead crane for moving the device from place to place, the heaviest locomotive can be moved 20 feet in 1 1/2 minutes, and it is claimed that one shop day is saved for every locomotive overhauled.

DISTRIBUTION OF MACHINERY EXPORTS

It is of interest to note that the United Kingdom, Canada, and Germany are our largest customers for metal-working machinery. The exports to these three countries total more than one-half of the entire exports of metal-working machinery from the United States. In 1927, the last year for which complete statistics are available, the United Kingdom took 22.5 per cent; Canada, 18 per cent; and Germany, 12.5 per cent of these exports. Next came France with 8.6 per cent, Japan with approximately 5 per cent, and Russia, with approximately 4 per cent. The exports to Australia amounted to 3.5 per cent, and to Italy, 2.3 per cent of the total. These eight countries absorb 77 per cent of all the metal-working machinery exported.

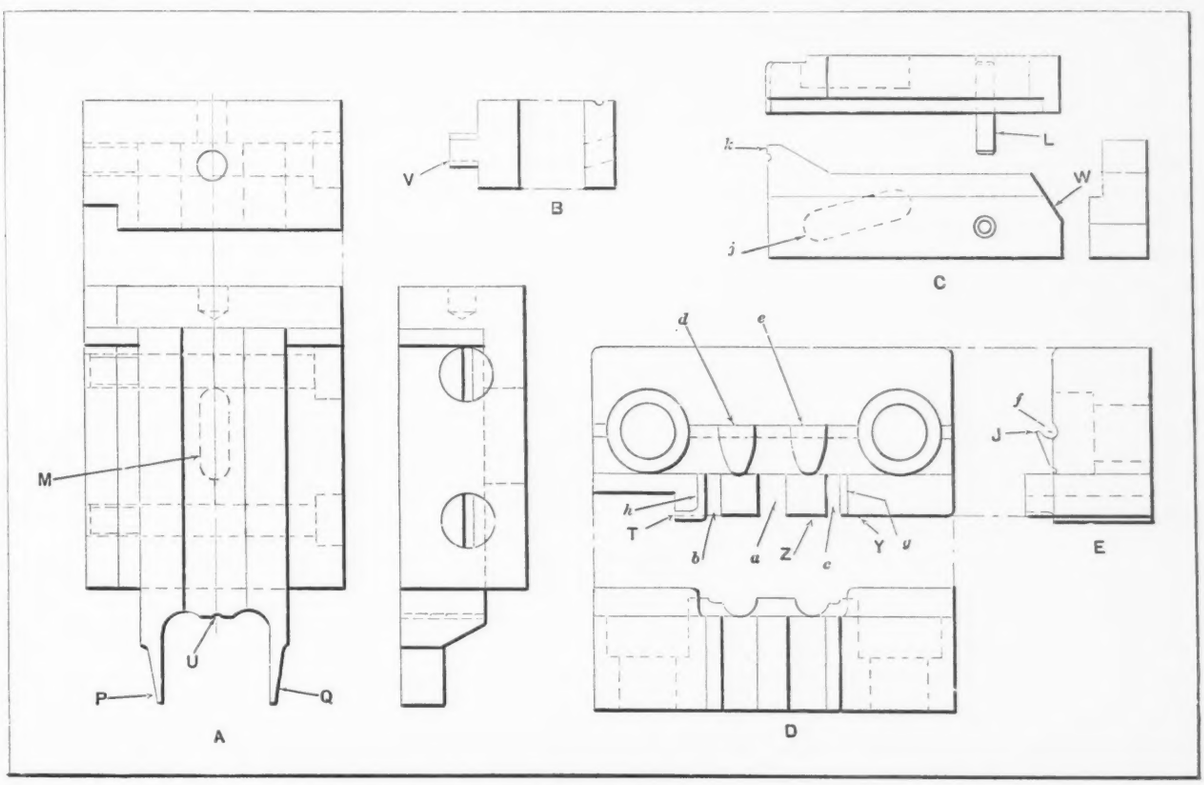


Fig. 5. Details of Upper Member of Die Shown in Figs. 3 and 4

The South American market in this field has probably been somewhat overestimated. All the South American countries, Mexico, and Central America, taken together, absorb less than 9 per cent of the total exports. As the exports as a whole amounted to only 15 per cent of the total production, it is evident that the South American, Mexican, and Central American markets absorb only 1.3 per cent of the total production of metal-working machinery in the United States. Like all other foreign markets, it should be taken care of and cultivated, but, in comparison with all the markets for machine tools, domestic and foreign, it is not to be considered as one of the more important outlets for metal-working machinery.

* * *

Although water power and oil are of great importance as a means of generating power, three-fourths of the world's generated power is produced by coal.

LUBRICATION OF HIGH-SPEED GEARING

In a paper read before the Engineers Society of Western Pennsylvania, E. N. Twogood of the General Electric Co., Lynn, Mass., pointed out the need for adequate lubrication of high-speed gearing. For long life and satisfactory operation, an oil film must be kept continuously on the gear teeth. The bearings must also be kept well oiled to prevent excessive wear, which would cause poor tooth contact and noisy operation. In high-speed gearing, the teeth must not run in oil, as this would cause excessive heating due to the high rotation of the gear in the oil, and the efficiency of the gears would be lowered.

It is difficult to keep oil on the teeth of high-speed gears because of the centrifugal force. The general practice, therefore, is to devise some method of putting the oil on the teeth just before they mesh and, in this way, the gear tooth carries the oil to the bottom of the working face of the pinion tooth, and the pinion tooth carries the oil to the bottom of the tooth surface of the gear. Thus both surfaces are well lubricated.

There are many methods of supplying oil to the meshing teeth. One very good way is by the spoon oil nozzle, which directs a thin wide film into the meshing teeth with the minimum quantity of oil. In this way, very good lubrication is obtained with about one-half gallon of oil per minute for each inch of gear face. The bearings, of course, require the proper amount of oil to carry away the heat generated, depending upon the size of the journals and the speeds, this requirement being from 0.05 to 0.08 gallon per minute per square inch of projected area. For successful operation, experience shows that for high-speed gears, both the meshing teeth and the bearings should be force-lubricated, the oil being furnished either by a pump driven from one of the gear shafts or by a pump driven from the driving or driven elements.

A WELL DESIGNED EXHAUST SYSTEM

In many plants where heavy grinding machines —such as the spindle jack, the disk grinder, and the swing grinder—are in use, the abrasive and metal dust in the air is both a serious health hazard to the employes and the cause of undue wear on expensive tool equipment. In such plants, an adequate dust-collecting system should be installed. Data prepared by the State Boards of Hygiene show that the presence of abrasive materials in the air greatly shortens life.

In former years, workmen were always available who would accept a job without regard to working conditions, but now the plant that does not make its shops as sanitary as possible—if not attractive—must expect a high labor turnover. In other words, workmen will be more contented and the production will increase when the atmosphere is kept clean and free from harmful dust and gases.

To be really of value, a dust-collecting installation should be so designed that it will carry the material to a point where it cannot possibly cause harm. It should also be so planned as to take advantage of every opportunity for the saving of power. The desired result should be obtained without interfering with the operation of the machines. Generally, this means that the hoods for collecting the dust at the point of origin must be designed especially for the machines on which they are installed.

An installation at the plant of the Fedders Mfg. Co., Buffalo, N. Y., which is a good example of an efficient abrasive dust-collecting system for buffing wheels, is shown in Fig. 1. In this illustration, the hoods are shown with the side plates *A* folded back to permit the removal of the wheels. Incidentally, it might be mentioned that in this installation the grinding or buffing wheels exert a centrifugal force which tends to throw the dust a considerable distance. Consequently, the hood for each machine

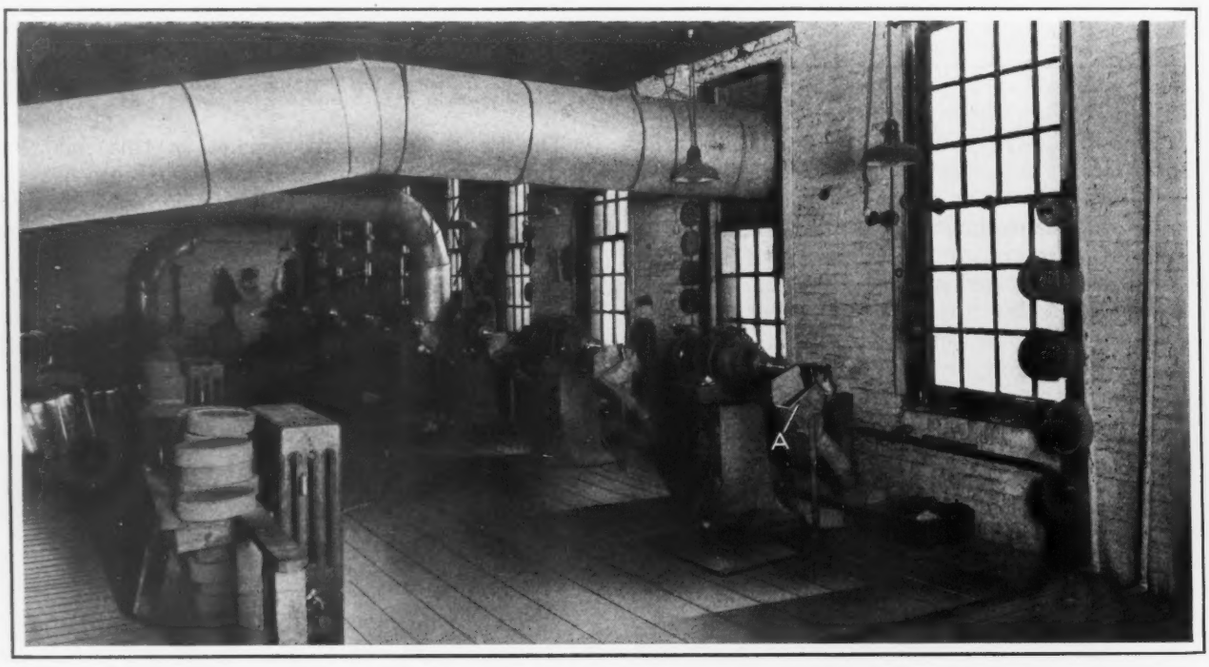


Fig. 1. Line of Buffing Machines with Side Plates of Exhaust System Folded back to Permit Removal or Replacement of Wheels

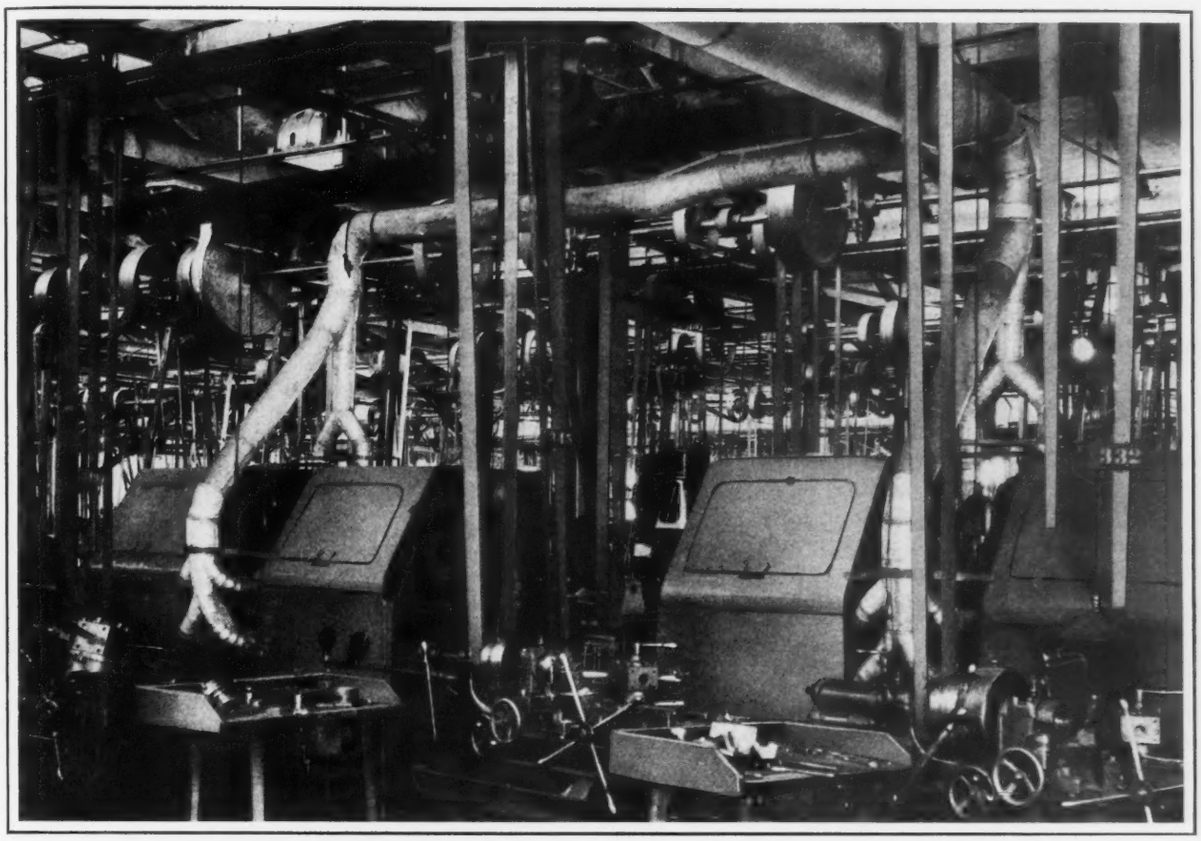


Fig. 2. Example of Properly Installed Exhaust Piping for Removing Metal Dust

is so designed as to make use of this force to carry the dust several feet into the ducts before any suction is required, an arrangement that means a considerable saving of power.

In Fig. 2 are shown the exhaust leads for the removal of metal dust in the machine room of the King Mfg. Co., Buffalo, N. Y. This is another illustration of efficient equipment which cuts down the health hazard and lessens the wear on tools and equipment.

H. L. KAUFFMAN

* * *

MACHINERY EXPORTS IN MAY

The industrial machinery exports from the United States during May, the latest month for which complete statistics are available, totaled $20,887,000. The exports for the five months ending May 31, 1929 totaled over $110,000,000, as compared with $84,000,000 for the corresponding period last year.

Of the exports during May, 1929, metal-working machinery represented a value of nearly $3,000,000, as compared with $2,550,000 for the corresponding month last year. During the first five months of 1929, metal-working machinery to a value of $17,225,000 has been exported, as compared with $12,250,000 last year, an increase of about 40 per cent.

* * *

The increasing use of oil-electric locomotives is evidenced by the fact that the Illinois Central Railroad Co. has recently ordered five 600-horsepower locomotives of this type from the Ingersoll-Rand Co., New York City, and the General Electric Co., Schenectady, N. Y.

RECENT DEVELOPMENTS IN AIR TRANSPORTATION

The rapid growth of the air transportation industry was well illustrated in a paper read by P. G. Johnson, president of the Boeing Airplane Co., the Boeing Air Transport, Inc., and the Pacific Air Transport, at the meeting of the American Society of Mechanical Engineers at Salt Lake City, Utah. Mr. Johnson pointed out that there are 21,000 miles of established airways and 1600 airports in the United States.

As an index of how suddenly the airplane industry has come into being, he gave the following figures on production of planes in the United States: 1919, 622 planes; 1921, 302 planes; 1923, 587 planes; 1925, 789 planes; 1926, 1186 planes; 1927, 1962 planes; 1928, 4000 planes; and for 1929 an estimated production of 12,000 planes. The production in the early years was largely military, and in 1921 practically every plane sold was for Army or Navy use.

Other figures show the recent trends in commercial aviation and point to the future. The air mail carried in 1928 was 2.37 times that transported in 1927, and more striking still was the transportation of practically twice as much mail in the last five months of 1928 as during the first seven months of the year. Planes in commercial use over scheduled routes numbered 128 in 1927 and 227 in 1928, while the total of civil planes increased from 3731 in 1927 to 7800 in 1928.

The average charge, in the United States, for air travel is 11 cents a mile, according to a compilation made by the traffic department of the Boeing system.

ELECTRIC OVENS FOR DRYING LACQUER

By RUSSELL J. WALDO

Lacquer is now used on every conceivable product ranging from automobile bodies down to the smallest articles. Its adoption as a regular finish in scores of industries has aroused considerable interest in the methods by which it can be applied and dried. This demand has encouraged manufacturers to experiment with and engage in the development of equipment for applying and drying the lacquer in the shortest possible time and at a minimum cost.

Early experiments showed that the old type of fuel-heated ovens used for japanning would not handle the new lacquer drying work with sufficient rapidity to meet the requirements of the automobile and electrical manufacturing industries. Some of the manufacturers in these fields, in an endeavor to find a furnace of suitable design, selected the newly developed, low-temperature, electrically heated ovens as a solution to the problem.

Requirements for Lacquer Drying

The first step in adapting the electrical furnaces for lacquer drying was to determine the temperature that would complete the baking process in the shortest possible time consistent with thorough seasoning. This must, of course, be accomplished without detriment to the appearance of the finish.

For this work, it is necessary to have a heat that will evaporate the solvents and oxidize the oils and gums. A ventilating system designed to carry off the vapors and to furnish oxygen for setting the oils and gums is also a necessity. The highly inflammable nature of the vapors makes their removal a factor that must not be overlooked.

The maintenance of a uniform temperature in all parts of the furnace gave considerable trouble at first. Under such conditions, a uniform finish could not be obtained. Another problem was to exclude from the furnace all foreign particles that might cause blemishes. These difficulties, however, have now been satisfactorily overcome.

Best Results from Using Only One Lacquer

Although the application of lacquer has not yet passed the experimental stage, it has been quite definitely established that the best results are obtained by selecting one brand of lacquer and continuing to use it. There are as many problems to be solved in applying lacquer as there are brands. A certain amount of experimenting must be done with each before the best results can be obtained. Although it was first thought that atmospheric conditions and ventilation seemed to have little effect on the lacquer, it has been proved that these two factors play an important part in the quality of the finish.

Types of Ovens Available

The smaller type of industrial electrical oven is now available in various sizes having openings ranging from 1 foot square by 16 inches deep to about 5 feet square by 3 feet deep. The thickness of the heat insulating material ranges from 1 inch to 3 inches, and the number of heating units varies from 1 to 8. Within this range even the smaller manufacturing concerns can generally find an oven adapted to their requirements.

Ovens of this type are designed especially for operations such as tempering, drying, and baking, where the temperature need not exceed 700 degrees. The insulation is firmly compressed between two walls of rust-resisting sheet iron. The heating elements of the oven are of a standard type and are carefully screened. They are generally placed in the bottom of the oven.

The controlling apparatus is conveniently located on the side of the oven. In the smaller sizes, the heat control is obtained by three snap switches. For the larger sizes, automatic control is obtained by means of a thermostat which operates either a motor-control switch or a control panel, depending upon the number of heaters installed. The smaller size furnaces are provided with shelves, while the larger sizes are equipped with angle-iron racks which support either shelves or rods.

Method of Ventilating Ovens

Ventilation of electric ovens is secured through a vent pipe in the roof, which is controlled by a damper. This pipe is extended to the outside of the building, making the drying room practically free from lacquer odors. When natural ventilation is insufficient, an electric fan is employed.

Considerable experimenting is sometimes required in adjusting the ventilating system so that the lacquer is properly dried. In many cases, the gases evolved in lacquer baking can be more readily removed from a point near the floor line than from the roof of the oven. Explosions such as might occur as a result of the accumulation of gas in the bottom of the oven are avoided by using the floor-line ventilating method.

The time required for baking lacquer is also considerably reduced through the use of floor ventilation. The time, as given by several manufacturers, varies from one-quarter to one-third of that required with the roof type of ventilating system. The more uniform distribution of heat obtained by removing the gases from a point near the floor also gives a more satisfactory finish.

While no definite rule can be given concerning the number of times the air should be changed during the baking operation, this should be done from seven to twenty-five times, depending upon the consistency of the lacquer and the temperature at which it is being baked. This is one of the factors that must be determined by experiment.

The color of the lacquer determines to a considerable extent the method of baking. Unless white lacquer is baked at a low temperature—close to 150 degrees or under—it will turn a yellowish color. This slow heat makes it necessary to bake the lacquer for a period of four hours in some cases. In baking black lacquer, a hot oven, having a temperature of about 500 degrees, is required, and the baking time ranges from approximately one-half to three-quarters of an hour.

Unless the oven is properly insulated, the loss of heat through radiation will make it difficult to maintain an even temperature. Ovens having thin insulating walls or walls of inferior insulating material will not give satisfactory results.

Monoplane with which Collyer and Mears Encircled the Globe in Twenty-three Days

Heat-Treating Alloy Steel Airplane Parts

The Exacting Conditions of Airplane Service Demand the Best Steels Heat-treated to Carefully Predetermined Temperatures

By C. B. PHILLIPS, Vice-president, The Surface Combustion Co.

THE development of alloy steels and methods of heat-treating them to bring out the desired physical characteristics has been one of the greatest aids in the advancement of aviation. Stronger and lighter construction, both in the plane itself and in the engine, are goals sought by all airplane designers, and it is in furthering the attainment of these goals that the metallurgist gives invaluable service. The present article describes the heat-treatment of various parts used in the construction of airplanes by the Fairchild Airplane Mfg. Corporation, Farmingdale, Long Island, N. Y. This concern has recently built a factory that includes a completely equipped metallurgical department.

Readers of MACHINERY will remember that it was a Fairchild airplane that took Collyer and Mears around the world in twenty-three days, and that a plane of the same make first reached the stranded fliers of the *Bremen* on Greenely Island, Labrador. Byrd, in preliminary explorations of the territory around the South Pole, also used a Fairchild plane.

In addition to single-engine cabin monoplanes, the concern builds engines, flying boats, and pontoons. Its latest type of engine is the "Genet," which is of English design, manufactured under American rights. This engine is of the radial air-cooled type, and has a rating of 80 horsepower.

Chrome-molybdenum Steel Used for Fuselage Tubes and Welded Fittings

More than ten different alloy steels go into the manufacture of the planes and engines made by this company, and most of them are heat-treated to produce the greatest strength, toughness, etc. Tubing for the fuselage, as well as welded fittings, is made of a chrome-molybdenum steel having the following analysis: Carbon, 0.25 to 0.35 per cent; manganese, 0.40 to 0.70 per cent; phosphorus, 0.040 per cent maximum; sulphur, 0.045 per cent maximum; chromium, 0.80 to 1.10 per cent; and molybdenum, 0.15 to 0.25 per cent.

This alloy is used because its strength is least affected in welding parts together. The heat-treatment used consists of heating to between 1550 and 1650 degrees F., quenching in oil and then tempering to approximately 1000 degrees F.

Low-carbon Steel Employed for Fittings Brazed to Parts

Fittings that are to be brazed with a gas torch, instead of welded, are made from a low-carbon steel, the analysis of which is as follows: Carbon, 0.20 to 0.30 per cent; manganese, 0.50 to 0.80 per cent; sulphur, 0.045 per cent maximum; and phosphorus, 0.05 per cent maximum. The heat-treatment given this steel is the same as that used with

the chrome-molybdenum steel mentioned, except that the hardening temperature is 25 degrees higher.

Bolts and Other Small Parts are Made from Nickel Steel

Bolts, taper pins, and small machined parts are made of a nickel steel of the following analysis: Carbon, 0.25 to 0.35 per cent; manganese, 0.50 to 0.80 per cent; phosphorus, 0.04 per cent maximum; sulphur, 0.045 per cent maximum; and nickel, 3.25 to 3.75 per cent. As the parts mentioned are mainly produced from bar stock, the only heat-treatment necessary is to heat them to between 1450 and 1500 degrees F., quench in water and temper to from 900 to 1050 degrees F. The hardening gives a tensile strength somewhat over 150,000 pounds per square inch and a yield point in excess of 125,000 pounds per square inch, but these properties drop with the tempering.

Chrome-nickel Steel Used for Parts to be Casehardened, Forgings, and Fittings

Casehardened parts such as piston-pins, cam follower tappets, and valve cams are made from a chrome-nickel steel having an analysis of: Carbon, 0.10 to 0.20 per cent; manganese, 0.30 to 0.60 per cent; phosphorus, 0.04 per cent maximum; sulphur, 0.045 per cent maximum; nickel, 1.00 to 1.50 per cent; and chromium, 0.45 to 0.75 per cent.

With a view to obtaining maximum hardness of the case and maximum refinement of both the case and the core, together with minimum distortion, the parts are first carburized at from 1625 to 1675 degrees F., after which they are allowed to cool in the boxes. They are then reheated to between 1400 and 1450 degrees F., quenched in oil, and tempered at from 250 to 500 degrees F., as required.

Forgings and fittings machined from bar stock, such as wing hinges, strut links, strut sockets and ball ends, which require greater strength and toughness than are obtainable with plain carbon steel, are made from a chrome-nickel steel similar in analysis to the one just described, except that it contains somewhat more carbon and manganese. As the grain structure of forgings is less uniform than that of bar stock in most cases, the former must be normalized by heating to from 1625 to 1725 degrees F. The heat-treatment for both forgings and bar stock products made from this alloy, exclusive of normalizing the forgings, consists of heating the parts to from 1475 to 1525 degrees F., quenching in oil, and tempering to between 950 and 1000 degrees F.

General View of Heat-treating Department in a Modern Airplane Manufacturing Plant

Chrome-vanadium Alloys Used for Crankshafts, Connecting-rods and Other Parts

Studs, engine rocker-arm forgings, crankshafts, connecting-rods, and similar parts are made from a chrome-vanadium steel, as such parts require great strength, toughness, and resistance to fatigue. The steel used for these parts consists of Carbon, 0.30 to 0.40 per cent; manganese, 0.50 to 0.80 per cent; phosphorus, 0.04 per cent maximum; sulphur, 0.04 per cent maximum; chromium, 0.80 to 1.10 per cent; and vanadium, 0.15 per cent minimum, and 0.18 per cent desired.

Forgings made from this steel must be normalized in the same manner as the chrome-nickel steel forgings, after which they are reheated to from

1550 to 1650 degrees F., quenched in oil and tempered to 1000 degrees F. Those parts that are to be machined after forging and before hardening are first normalized, reheated to between 1250 and 1350 degrees F., allowed to cool slowly, and then machined. After that they are heated again to from 1550 to 1650 degrees F., quenched in oil, and tempered to 1000 degrees F.

Parts such as valve springs, gears, and couplings that must have greater strength than is obtained with the foregoing alloy are made from a steel similar in analysis but with a 0.10 per cent higher carbon content. These parts are generally normalized at from 1650 to 1750 degrees F., reheated to from 1525 to 1625 degrees F., quenched in oil, and tempered to about 650 degrees F.

However, parts such as gears, which are to be machined after forging, are reheated to between 1250 and 1350 degrees F. immediately after normalizing, and cooled slowly. They are then machined and the remainder of the heat-treatment just described is given them.

Another chrome-vanadium steel, which is primarily a tool steel, is used as an anti-friction bearing material in push-rod ball ends, rocker-arm rollers, etc. It has the following analysis: Carbon, 0.90 to 1.05 per cent; manganese, 0.20 to 0.45 per cent; phosphorus, 0.03 per cent maximum; sulphur, 0.03 per cent maximum; chromium, 0.80 to 1.10 per cent; and vanadium, 0.15 per cent minimum and 0.18 per cent desired.

Parts made from this alloy are first normalized at from 1650 to 1750 degrees F., and cooled to a black heat of 1000 degrees F., by opening the furnace. They are then reheated to from 1300 to 1350 degrees F. and "soaked" for at least thirty-six hours or until the desired structure and machineability are produced, after which they are cooled slowly in the furnace. When they have been machined, the parts are heated to from 1500 to 1550 degrees F., quenched in oil and first tempered to between 350 and 400 degrees F. Then the parts, with the exception of surfaces that are subjected to wear, are drawn in lead to a temperature of about 900 degrees F.

Lay-out of the Heat-treating Department

In the heat-treating department of this plant, there are seven furnaces, including oil tempering equipment, all of which use gas for fuel. The four largest furnaces are standard units of the Surface Combustion Co. They have cast-iron sections, so designed that warping is successfully resisted and there is no tendency for the furnaces to spring out of alignment. The linings are made of firebrick and tile to a thickness of 4 1/2 inches, which is considered thick enough to maintain rigidity, but not so thick as to absorb and waste heat in any large amount. There is 2 1/2 inches of heat-resisting insulation to prevent radiation losses through the walls or doors.

The largest of these furnaces is 8 feet long inside, 3 feet wide, and 20 inches high. This unit is equipped with five high-pressure gas burners on each side, connected through a manifold to Surface Combustion inspirators. This system of firing provides an effective temperature range of from 700 to 1650 degrees F. The heat is rapidly and uniformly distributed to all parts of the furnace from a restricted and controlled zone of combustion. The smaller furnaces are similar in design and construction. All of them are provided with automatic temperature controls, so that if the proper time cycle is maintained, there will be no variation in the heat-treatment given different charges of work.

In addition to the heat-treatment given alloy steel parts, all Duralumin parts are heat-treated in the same furnaces.

* * *

Standardized Drill Jigs

Competition and the necessity of eliminating waste are forcing manufacturers to employ more and more efficient and economic tooling equipment and to seek new methods of reducing production costs. In the design of drill jigs, there is a promising opportunity for savings, both in the actual cost of jigs and in the expense incident to their use. By standardizing the design of drill jigs, it is possible to reduce their first cost, and by so designing them that they can be loaded and unloaded in the shortest possible time, it is possible to reduce the cost of operation. An article in September MACHINERY, "Standardized Jigs for Production Drilling," illustrates and tabulates details of standardized drill jigs of various sizes, equipped with quick-acting work-clamping levers and adapted for a large variety of work. The equipment engineer and tool designer will find this article of particular value as a guide in standardization.

ALUMINUM ALLOY TRUCK BODIES

The practice of building truck and trailer bodies of aluminum alloy shapes is growing. The chief reason for using aluminum is that most states impose legal restrictions with regard to the gross weight of vehicles using the public highways. By lightening the bodies, additional loads can be transported without increased running cost or wear and tear on the chassis. Although with the use of aluminum, the first cost of the truck is increased anywhere from $225 to $600, this is offset in some degree by the extended life of the aluminum bodies, as compared with ordinary truck bodies, due to the non-corrosive qualities of aluminum. The final junk value is also much greater.

In one case, it is estimated that the actual saving during a year's operation, where a truck body was made of aluminum alloy, was $529, while the added first cost of the aluminum body and hoist was $700. From this it would seem that the use of aluminum bodies is economical.

* * *

An apparatus used for recording the speed of racing cars at different points along the course has been developed in England, according to *Engineering*. Several contact strips are located at accurately measured distances apart along the track. As a car passes over each of these strips, electric contacts are made, which, in combination with a clock mechanism, actuate pens by means of which a diagrammatic record is made of the speed of the car.

"BOHNALITE"—A NEW LIGHT ALLOY

A new light weight alloy suitable for castings and forgings, known as "Bohnalite," has been developed by the Bohn Aluminum & Brass Corporation, Detroit, Mich. A high and uniform hardness, great density, fine grain structure, lightness, strength, and durability are claimed for this new alloy. It is not subject to rapid rusting or corrosion, and ordinarily need not be painted or enameled; instead, it may be polished to resemble silver. It is easily machined and can be heat-treated to increase the physical properties.

Being light in weight, it is evident that Bohnalite would be particularly suited to the building of aircraft equipment. The alloy best suited for aircraft engine crankcases, magneto brackets, cylinder heads, and other parts has a tensile strength, sand-cast, of from 28,000 to 45,000 pounds per square inch, an elastic limit of from 18,000 to 27,000 pounds per square inch, and a specific gravity of 2.78. Other Bohnalite alloys have a tensile strength up to 55,000 pounds per square inch, with an elastic limit up to 30,000 pounds per square inch.

Aside from their use in aircraft and automobile parts, Bohnalite alloys have been developed for a number of different uses. For vacuum cleaners and similar domestic machines, an alloy that will take a high, lasting polish and that is free from pin-holes is essential. A Bohnalite alloy having a tensile strength of from 20,000 to 23,000 pounds per square inch, an elastic limit of from 15,000 to 16,000 pounds per square inch, and a specific gravity of 2.83 meets these requirements. For washing machines, an alloy with a smooth surface and high resistance to corrosion is required. The alloy developed for this purpose has similar physical properties to the one used for vacuum cleaners. There are two alloys suitable for die-castings.

THE LEIPZIG TRADE FAIR

The Leipzig Trade Fair, long one of the world's great market places for the exchange of both goods and ideas, will be held August 25 to 31 in Leipzig, Germany. As it approaches its seven-hundredth anniversary, this exposition outclasses all other industrial exchanges in size and in volume of business transacted. The fair usually attracts some 180,000 visitors from all parts of the world; this year, 3000 are expected from the United States. American participation in the Leipzig Fair has steadily increased during recent years, the United States having had more than one hundred exhibits last year.

The autumn fair does not include the exhibition of machinery which takes place in the spring, usually early in March. At the last spring fair there were sixteen buildings devoted to the exhibition of the products of the machinery and engineering industries. A special building in this group is devoted entirely to machine tools and metal-working machinery. A large number of American machine tools are always exhibited in this building during the spring exposition.

Information concerning the fair may be obtained from the Leipzig Trade Fair, 11 W. 42nd St., New York City.

In the Section of the Machine Tool Exhibition at the Last Leipzig Fair Here Illustrated, More than One-half of the Machines Exhibited were of American Make

* * *

In an article in *Automotive Industries* calling attention to the rapid development of aerial transportation, it is stated that in 1911 some of the requirements for obtaining a pilot's license were that the pilot should have made at least two flights, each not less than three miles in length, without touching the ground, and that he should have made an altitude test rising to a height of at least 150 feet above the starting point.

New Machinery and Shop Equipment

A Monthly Record of New Metal-working Machinery, Tools, and Devices for Increasing Manufacturing Efficiency and Reducing Costs

ENTERPRISE ROTARY MULTIPLE-TYPE MACHINE

Drilling, reaming, tapping, boring, facing, hollow-milling, and similar operations can be performed on a vertical continuous-type machine now being introduced on the market by the Enterprise Mfg. Co. of Pennsylvania, Third and Dauphin Sts., Philadelphia, Pa. This "Enterprise Multiple," as it is called, has been developed primarily for high-speed production in the automotive, radio, and electrical fields. When production requirements are sufficiently high, a battery of machines may be employed for performing various operations in sequence on a part; for example, the machine here illustrated is arranged for drilling a hole in automobile tire locks. However, when production requirements are lower, one machine can be arranged for successively performing different operations.

Eight tool-spindles and work-tables are mounted on a carrier which revolves constantly around a vertical column. Each table maintains a central position relative to the corresponding tool-spindle as the carrier rotates. During their passage around the column, the tables are fed gradually upward to bring the work pieces into contact with the tools.

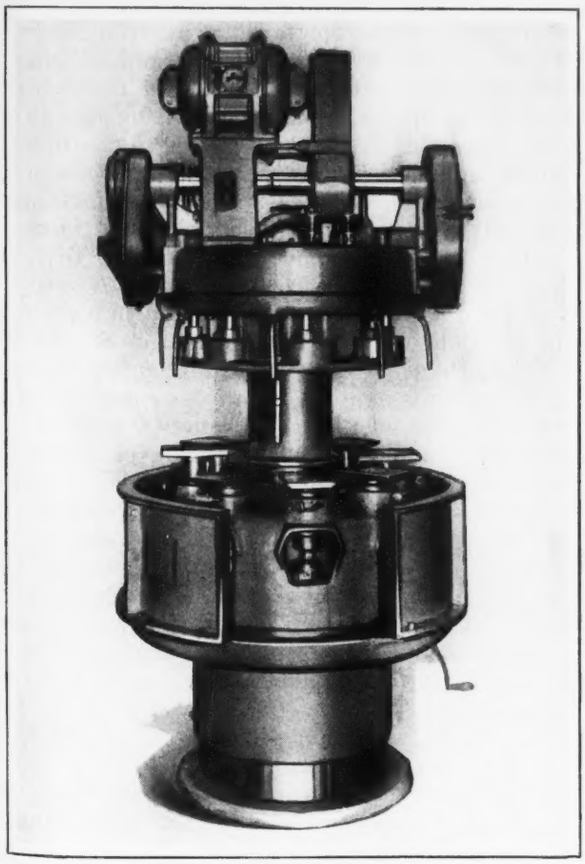


Fig. 1. Enterprise Continuous-operation Multiple-type Machine

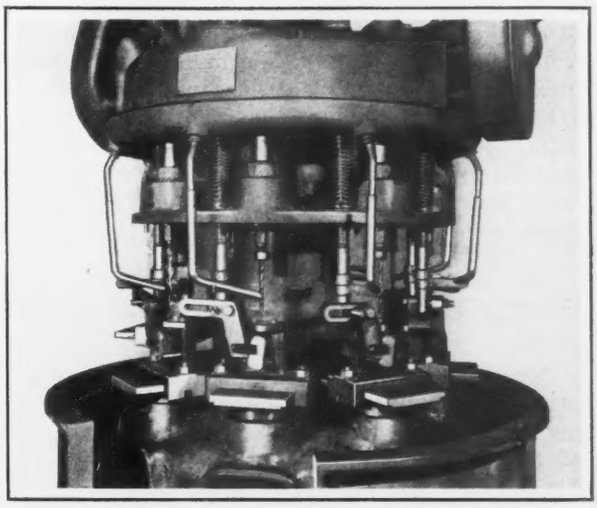


Fig. 2. The "Enterprise Multiple" Tooled up for a Typical Job

The feeding movement is accomplished by means of a roller attached to the bottom of each table plunger, this roller riding on a ring cam. The shape of the cam determines the feed motion.

As each table reaches the front of the machine, the cam shape causes the table to drop and thus lower the work clear of the tool, so that reloading can be conveniently done. In most cases, the work can be held in a jig which clamps it automatically, the operator merely having to insert and remove the work pieces.

When successive operations are to be performed on the same piece, the tools are mounted in sequence in the spindles. Then the operator advances the piece one spindle each time that it comes around to him until the piece is finished. He always places an unfinished part on the table beneath the spindle that performs the first operation. Cams may be mounted on the cam rail for indexing jigs, operating knock-outs, etc.

Spur gears at the upper ends of the spindles mesh with a large combined spur and bevel gear which is driven through a bevel pinion and a pair of spur gears located at the right-hand end of the overhead pulley shaft. Spindle speeds are changed by changing the pair of spur gears. The carrier is driven from the left-hand end of the pulley shaft through change-gears, planetary gearing, and bevel gearing. The carrier speeds are varied through the change-gears. The number of spindles that may be presented to the operator per minute with standard equipment ranges from 9 to 27.

Individual adjustment of the tables is available through right- and left-hand stems which extend through both parts of the table plungers. All the tables can be adjusted simultaneously by rotating a large nut on the column by means of a crank and worm geared to it. Lubrication of the machine is

amply provided for, and all gears and other working parts are enclosed.

Some of the important specifications of this machine are as follows: Maximum and minimum distance from a spindle to the top of the corresponding table when the table is at the highest point of the cam, 16 3/4 and 10 inches, respectively; total movement imparted by standard and special cams, 2 and 3 inches, respectively; distance from center of spindles to column, 6 1/2 inches; distance from center to center of spindles around circle, 9 inches; maximum depth of hole drilled with standard cam, 1 1/4 inches; maximum diameter of hole drilled in solid cast iron, 3/4 inch; maximum diameter of hole drilled in solid 0.40 per cent carbon steel, 5/8 inch; floor space occupied, 4 by 4 feet; and approximate weight, 5000 pounds.

PRODUCTO DOUBLE-SPINDLE CAM MILLING MACHINE

A motor-driven double-spindle machine designed primarily for milling two automobile brake-expanding cams simultaneously is a recent development of the Producto Machine Co., Bridgeport, Conn. These cams are approximately 1 1/2 inches long by 1/2 inch wide, and have two generously rounded corners, as well as two corners having a radius of 1/16 inch. The surface milled is 3/4 inch wide. The cam portion is integral with a shank. However, this No. M11D machine may also be used for milling other cams of various shapes, which do not have radii greater than 4 inches or a roller surface exceeding 4 inches in width.

The base of the machine and the enclosed transmission, with its speed and feed pick-off gears, are of the same design as those provided in the regular line of "Producto-Matics." Bolted to the top of the base is a heavy casting that has dovetailed ways in which slide *A*, Fig. 2, is operated for reloading the work. This slide carries two

Fig. 1. "Producto-Matic" Arranged for Milling Two Automobile Brake-expanding Cams Simultaneously

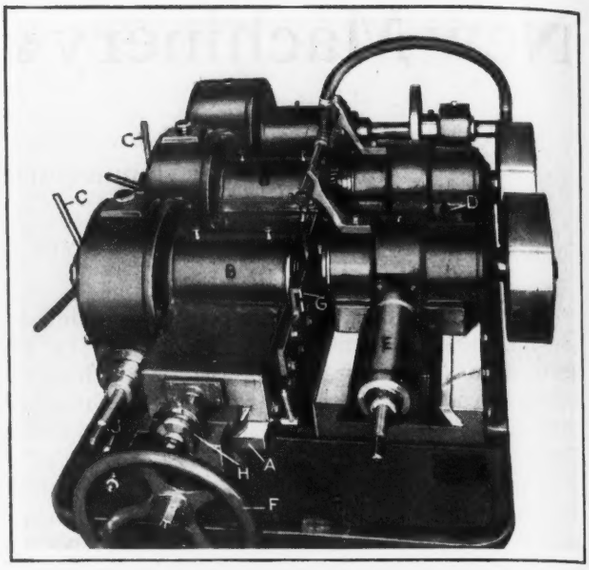


Fig. 2. Close-up View of the Work-heads and Cutter-slide

work-heads *B* which are adjustable to compensate for variations in cutter diameters. There is a revolving spindle in each head equipped with a spring collet which is opened and closed by operating the corresponding capstan wheel *C*.

Two cutter-spindles are mounted opposite the work-spindles in slide *D*, which is moved horizontally by a master cam at the rear of the machine, carrying the cutters forward and backward in accordance with the outline of the work pieces as they are revolved. A coil spring within housing *E* holds the cutter-slide roll against the master cam.

In loading the machine, the work-heads are simultaneously moved forward, away from their respective cutters, by turning the large handwheel *F* until the cams to be milled clear the cutter-heads, when their shanks are slipped into the spindle collets. Location of the work pieces in the collets is quickly accomplished by means of templets in the corresponding brackets *G*. These templets automatically slide out of the way when not in use.

After the collets have been loaded, they are closed by turning the capstan wheels *C*, and the work-heads are then moved forward into the milling position by revolving handwheel *F*. In this position, the work-head slide is accurately located by micrometer stop *H*. Both cams are milled at one revolution of the work-spindles, after which slide *A* is again moved forward for reloading. About 3/16 inch of stock is taken from the cams.

The two work-spindles and the two cutter-spindles, as well as the camshaft at the rear of the machine, are driven through worm-gearing and are equipped with Timken tapered roller bearings. Lever *J* is operated to engage the feed to the work-spindles and to the master cam when setting up the machine, while a clutch lever, conveniently located, controls the delivery of power from the motor to the transmission gear box. Handwheel *F* is equipped with a micrometer dial, which is advantageous in setting up the machine. The work- and cutter-spindles are of large diameter, namely, 6 and 3 1/2 inches, respectively. Smooth cutting action is obtained by mounting the flywheels on the outer ends of the cutter-spindles.

The master cam which actuates cutter-slide *D* is milled directly on its shaft after the shaft has been assembled in the machine. Previous to this operation, a milling cutter is substituted for the roll on the cutter-slide, and instead of milling cutters in the cutter-spindles, a roll is provided in one spindle which rides against a finished piece in the work-spindle opposite. To change the master cam, only one end bearing need be removed from the cam-shaft. Slide *D* can be adjusted 4 inches parallel with the center lines of the spindles to permit cams of different widths to be milled. The work-spindle chucks can be arranged for operation by air instead of manually, if desired.

THOMSON WELDING MACHINES

Two welding machines recently brought out by the Thomson Electric Welding Co., Lynn, Mass., are shown in the accompanying illustrations.

Fig. 1 shows a 180 series spot welder which differs from the conventional type in that the upper electrode has a vertical movement instead of a rocking arm. Also, the upper electrode is a multiple-pointed type designed to eliminate frequent replacement. Each electrode point is indexed successively and automatically into the proper position for welding during an up stroke of the upper slide. This equipment has been particularly designed for the high-speed welding of light parts which can be fed automatically to the welding machine, and for cases where it is necessary that all moving parts be as light as possible to permit high-speed operation without a hammering effect on the dies. Several hundred welds can be made per minute.

The power drive attachment employed for operating this welder is not shown, as the particular machine illustrated is one of several driven by a single power-drive unit.

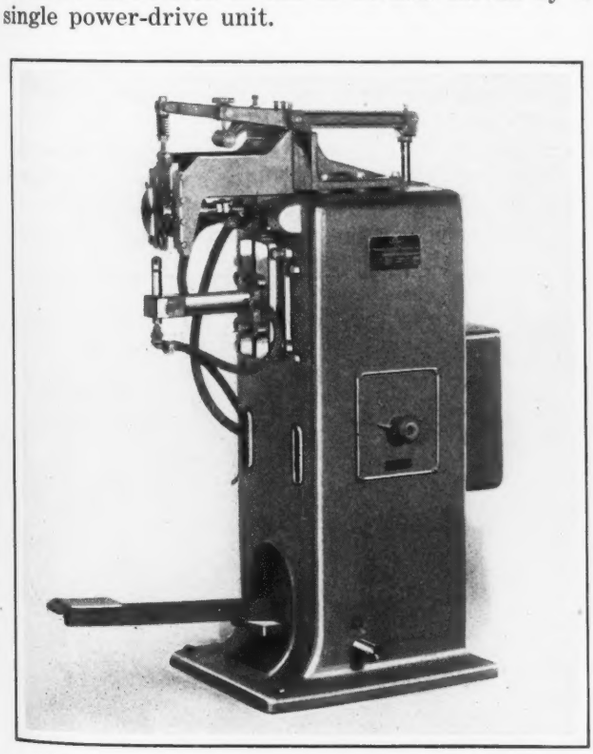


Fig. 1. Spot Welder with Indexing Upper Electrode Unit that Moves Vertically

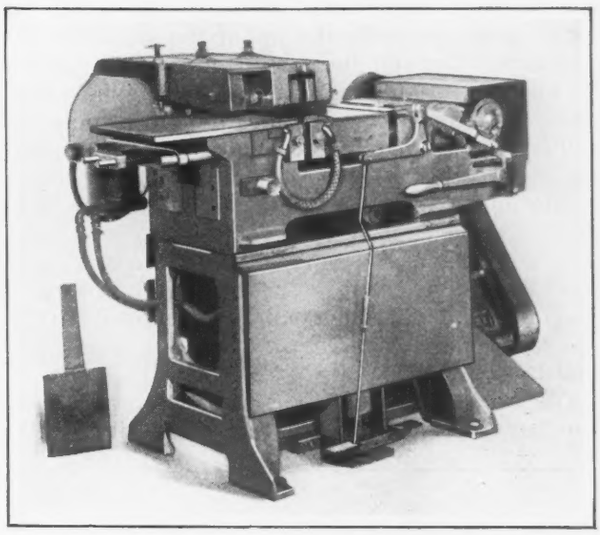


Fig. 2. Thomson Butt Welder Arranged with Special Air-operated Clamps and Holding Devices

The No. 12 butt welder, Fig. 2, is equipped with special air-operated clamps and holding devices to facilitate the welding of back straps to shovel blades. This welder has a water-cooled transformer rated at 60 kilovolt-amperes.

The right-hand or moving platen is mounted on round side-rods which slide in bearings at the right- and left-hand ends of the frame and are fully protected from flash. The air-operated clamps are of the direct-acting type. There are only two principal bearings in each half of the clamps, and these are furnished with bronze bushings and are also protected from flash. The clamp jaws are of a self-adjusting rocking type that insures parallel clamping.

The push-up device is driven by a one-horsepower motor which is belted direct to a gear reduction unit. The latter is direct-connected to a shaft that carries a cam for giving the necessary platen push-up movement. The return of the moving platen into the open or loading position is automatic with the release of the clamping pressure.

The cycle of the welding machine is automatically performed after the work has been clamped and the operator has depressed the foot-lever. The machine can be adapted for welding a wide range of flat strips or various shapes of bar stock by the application of proper clamping dies and jaws. In welding the back straps to the shovel blades, a production of 300 welds per hour is obtainable.

HIGH-SPEED SENSITIVE DRILLING MACHINE

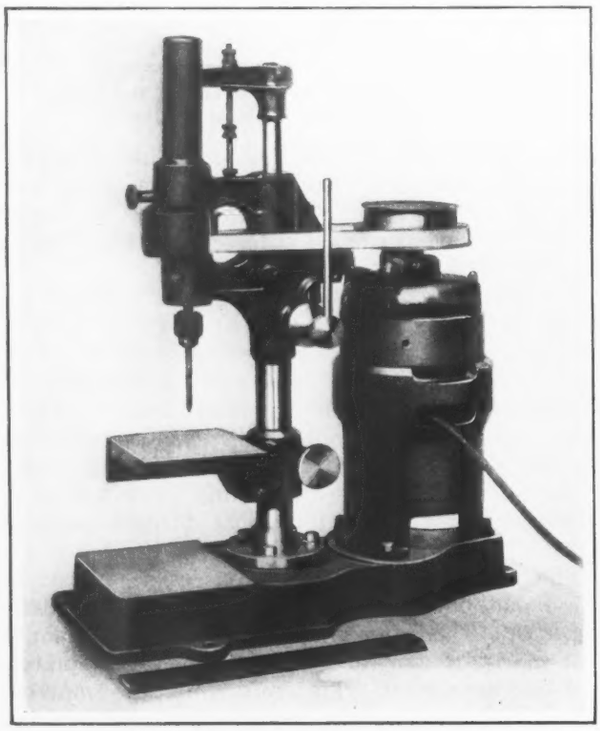
A model R-53 high-speed sensitive drilling machine designed to produce holes up to 1/4 inch in diameter has recently been added to the line of the High Speed Hammer Co., Inc., 305-321 Norton St., Rochester, N. Y. The spindle speeds of the standard machine illustrated are 2700 and 5500 revolutions per minute. However, the "Tool-room Special" is equipped with three-step pulleys to give speeds of 1500, 3000, and 6000 revolutions per minute. Either a direct- or alternating-current motor can be supplied for driving the equipment.

The hardened and ground spindle of the machine is guided in a vertical quill supported by annular

ball bearings which take all belt pull. Two ball thrust bearings carry the top of the spindle at the feed arm. The spindle travel can be set accurately by means of a depth gage, the maximum travel being 2 1/4 inches. In addition to the spindle, the quill, feed column, main column, table, and base are ground to size and into alignment.

The table can be quickly adjusted for height or entirely removed if necessary. The portion mounted on the column has a tapered surface which keeps the column free from chips and thus protects it from injury. The front pulley and upper part of the spindle are covered by a quickly detachable guard.

The working surface of the base measures 4 by 6 inches, and work up to 7 1/2 inches high can be



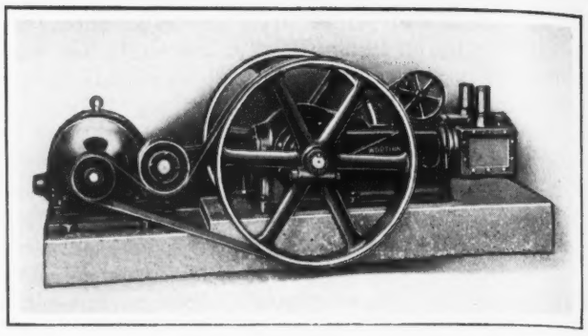
Motor-driven Sensitive Drilling Machine Made by the High Speed Hammer Co.

placed on it. The machine drills to the center of a 6-inch circle, has an over-all height of 24 1/2 inches, and a net weight of about 108 pounds.

WORTHINGTON COMPRESSORS EQUIPPED WITH TIMKEN BEARINGS

Timken tapered roller bearings are provided on the main crankshaft journals of a new line of air compressors now being introduced on the market by the Worthington Pump & Machinery Corporation, Harrison, N. J. These compressors are of the single horizontal straight-line type, and are made in capacities ranging from 100 to 300 cubic feet per minute. As these capacities are used mainly in the smaller power plants, many of which do not have skilled operators, it is claimed that the elimination of bearing adjustments has removed one of the principal causes of worry and expense in the operation of compressors installed in such plants.

Oil-rings, which deflect surplus oil and return it to the crankcase, are mounted on the shaft beyond



Worthington Air Compressor with Timken Bearings on Crankshaft Journals

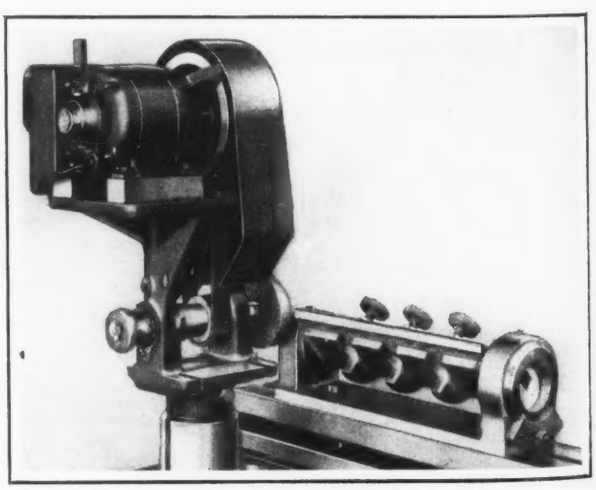
the Timken bearings. The crankcase is oil-tight. "Feather" valves are standard equipment on the compressors. These valves are light strips of steel, approximately 1/32 inch thick, which flex against a curved guard when opening to permit the passage of air.

The equipment may be regulated through an automatic starter and pressure switch mounted on the motor or a pressure regulator which may be attached to the inlet valves. These compressors can be furnished with ball-bearing idlers, as shown, for short belt drives. "Texrope" drives can also be provided or a synchronous motor can be connected direct to the crankshaft.

FIXTURE FOR REGRINDING CENTERLESS GRINDER SUPPORT BLADES

The attachment here illustrated has been developed by the Cincinnati Milling Machine Co., Cincinnati, Ohio, for use on the Cincinnati No. 1 1/2 plain cutter and tool grinder. It is intended for use in regrinding the wearing surfaces of all standard support blades used on the Nos. 2, 3, and 4 centerless grinders manufactured by Cincinnati Grinders, Inc.

These blades should be reground to eliminate the hollow resulting from wear, which causes chatter, out-of-roundness, and inaccuracy of the work. Then too, these troubles may often be corrected by changing the blade angle, which can be easily done with this equipment. Blades being reground will not warp, because they are held in the fixture in



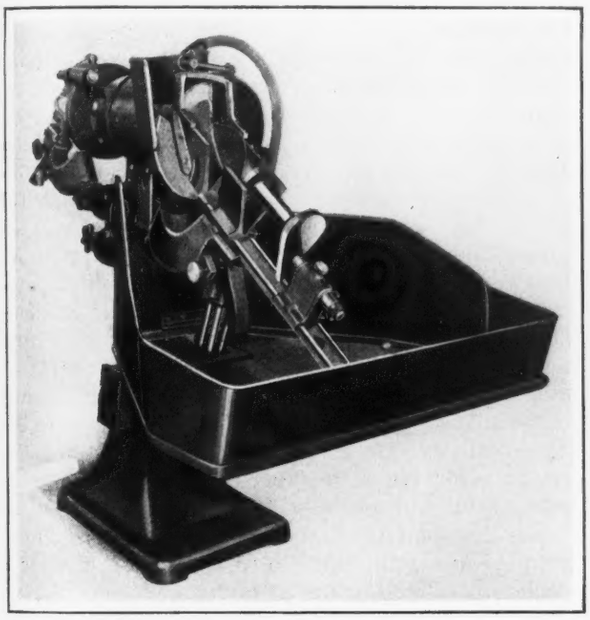
Attachment for Regrinding the Support Blades of Cincinnati Centerless Grinders

the same manner as on the centerless grinder. The time required for the set-up is only two minutes.

The fixture is made of aluminum, and takes support blades up to 16 5/8 inches long, 3/4 inch wide, and 4 inches high, to be ground at any angle from a flat top to 45 degrees. It can be applied to a cutter grinder already in use or supplied with a stripped machine.

GRAND RAPIDS SHARPENING MACHINE FOR LARGE TWIST DRILLS

Twist drills up to 5 inches in diameter can be sharpened on a machine recently brought out by the Gallmeyer & Livingston Co., 344 Straight Ave., S.W., Grand Rapids, Mich., which is believed to be the largest machine on the market for this purpose. The equipment is of the double holder type,



Grand Rapids Machine for Sharpening Drills up to 5 Inches in Diameter

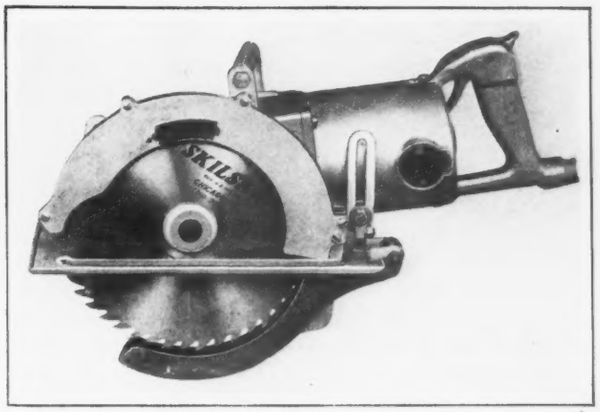
which gives it a capacity for drills from No. 52 up to 5 inches.

Both holders are of the non-calipering type, which makes it possible to change from sharpening one size of drill to another without taking any time for preliminary adjustments. It is also possible to change from grinding a straight-shank drill to a taper-shank drill and from a two-lip drill to a four-lip drill without any preliminary adjustments.

The smaller drills are ground dry on a fine-grain wheel on one side of the machine, while large drills are ground wet on a coarser wheel on the opposite side of the machine. A 1 1/2-horsepower motor is built into the head of the machine so as to form an integral part of the grinder. A patented wheel-truing mechanism equipped with a diamond is supplied for each wheel.

"SKILSAW" PORTABLE ELECTRIC SAW

Various metals can be cut with the model O portable electric saw here illustrated, which has recently been produced by Skilsaw, Inc., 3310-20 Elston Ave., Chicago, Ill. Different circular blades are



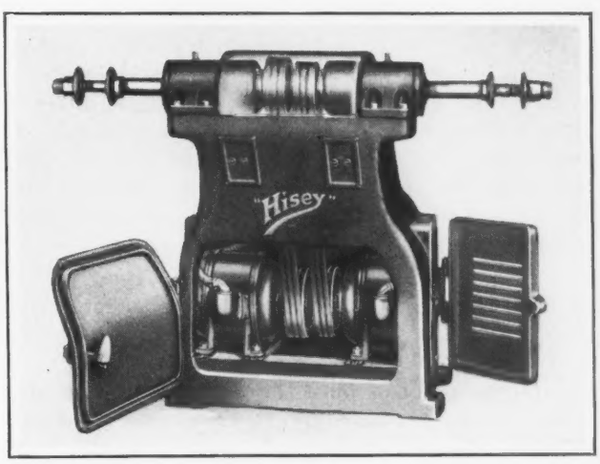
"Skilsaw" Portable Electric Saw which Cuts Various Metals

used for the various metals. For instance, when equipped with a special slitting blade, the saw will cut such metals as copper, lead, zinc, and brass, as well as corrugated or formed steel sheets of No. 22 gage or lighter. Equipped with a friction blade, the saw will cut angle-iron, metal weather stripping, and sheets of cold-rolled steel of No. 18 gage or lighter. Blades 10 inches in diameter are employed.

The saw is driven by a one-horsepower universal motor, which operates on direct current or alternating single-phase current of 60 cycles or less. Safety features include a guard and a trigger switch, which shuts off the motor the moment the finger grip on the pistol-like trigger is released. "Skilsaws" are made in four sizes.

HISEY DUAL-MOTORED "TEXROPE-DRIVEN" BUFFING MACHINE

The Hisey-Wolf Machine Co., Cincinnati, Ohio, has recently added to its line of buffing and polishing equipment a machine with two spindles that are independently driven by separate motors through "Texropes." Each of the motors has its own starter, and thus can be started or stopped at will. This arrangement makes it possible to operate the two spindles simultaneously at different speeds, and so the machine is particularly suitable for use in buffing departments where a large variety of work is handled.



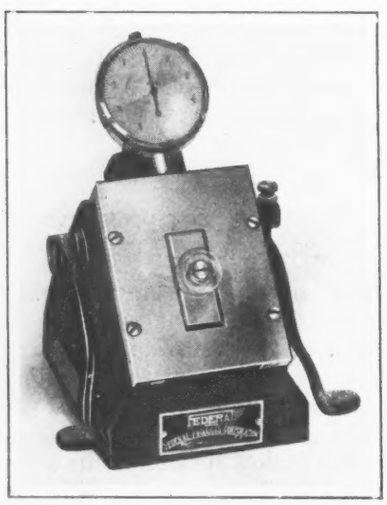
Hisey Two-spindle Buffing Machine with Separate "Texrope" Drives

In general construction, this dual-motored buffer closely follows the single-spindle machine described in May MACHINERY, page 700. It has the same gooseneck type of base, which allows the operator freedom of movement and facilitates the handling of large bulky parts. Both motors are mounted in the base compartment on planed ways, as illustrated. They can be readily adjusted forward or backward to obtain the desired belt tension.

The spindle and bearing housings are assembled in one unit, which may be quickly removed from the base by loosening four bolts on each side. This construction simplifies the problem of replacing a worn or broken belt with a new one. A wide range of spindle speeds is available on this machine by changing the motor pulleys.

FEDERAL SMALL-HOLE GAGE

A dial indicator gage designed for measuring roundness and size variations of holes from 3/8 to 1 1/2 inches in diameter has been added to the line of inspection equipment manufactured by the Federal Products Corporation, 1144 Eddy St., Providence, R. I. This model 36 gage is equipped with an indicator graduated to 0.0001 inch, the 0.001 inch graduations being 3/4 inch apart.



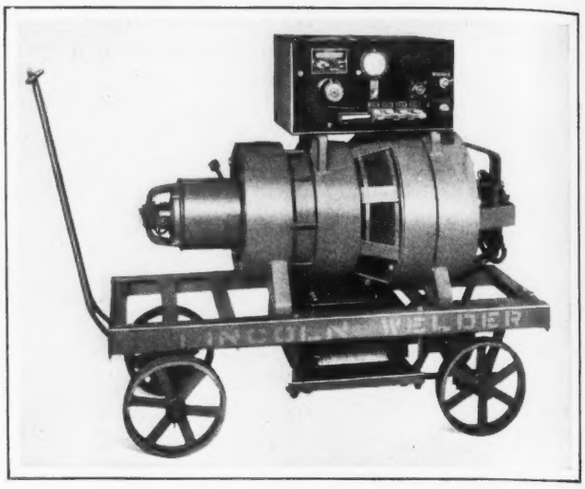
Federal Gage for Checking the Roundness and Size of Small Holes

The gage can be operated from either the right- or left-hand side, and parts can be inspected as rapidly as the operator can place them on the jaws. Out-of-roundness is determined by merely revolving the work on the jaws. Four different sizes of jaws are available for measuring holes from 3/8 to 1/2 inch, 1/2 to 3/4 inch, 3/4 to 1 1/8 inches, and 1 1/8 to 1 1/2 inches in diameter.

The gage is easily set to measure different sizes of holes by removing the top plate and loosening screws that clamp the lower jaw in a dovetail. Then a master is placed on the jaws or a micrometer is used and the jaws are set so that the indicator registers about 0.001 inch on the minus side of the zero line. After that, the jaws are again tightened and the gage is ready for use.

LINCOLN "STABLE-ARC" WELDERS WITH UNIFIED CONTROL

Unified control of both the motor and generator is one of the principal features of the improved "Stable-Arc" welders recently placed on the market by the Lincoln Electric Co., Cleveland, Ohio. The working mechanism of all controls is contained in a ventilated enclosed steel cabinet having the hand regulators and switches mounted on a panel which forms one side of the cabinet. The control panel contains a rheostat regulator, diverter switch, safety starter switch, volt-ammeter, and wing-nut terminals for cables. The cabinet is mounted directly over the motor-generator, as illustrated, for easy access, and this location also enables the motor-generator armature to be removed without disturbing any other parts. The arrangement also permits the use of a shorter chassis frame or base.



Lincoln "Stable-arc" Welder with Unified Control

The volt-ammeter or combined voltmeter and ammeter, makes it possible to read the amount of voltage and amperage on one dial and eliminates the use of a separate ammeter, which would be subjected to excessive wear. The wing-nuts on the terminals for the lead cables make quick connections possible, especially when it is desired to reverse the polarity of the welding current. These terminals also eliminate the necessity of having a switch for reversing the polarity.

The Lincoln safety push-button switch, described in February MACHINERY, page 468, is incorporated in the control panel for starting and stopping the welder. With this switch it is impossible to start the equipment accidentally.

DETROIT VISE FOR DRILLING AND MILLING MACHINES

A rapid-action vise with a positive locking mechanism has recently been brought out by the Equip-

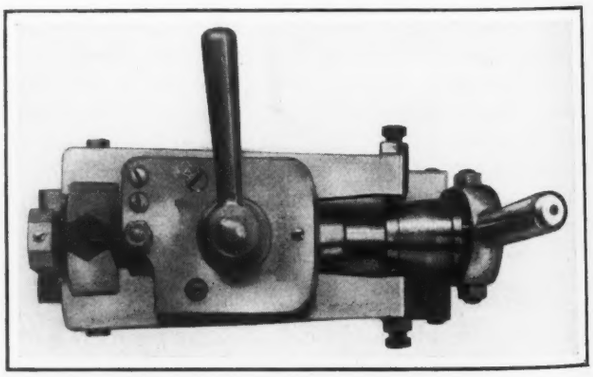


Fig. 1. Drilling and Milling Vise Made by the Equipment Co. (Top View)

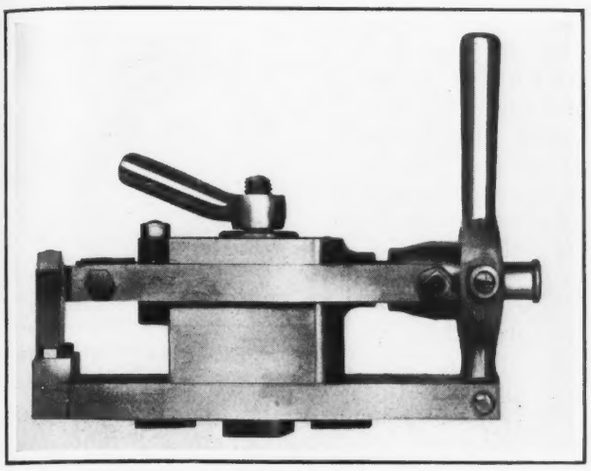


Fig. 2. Front View of the Quick-acting Vise Shown in Fig. 1

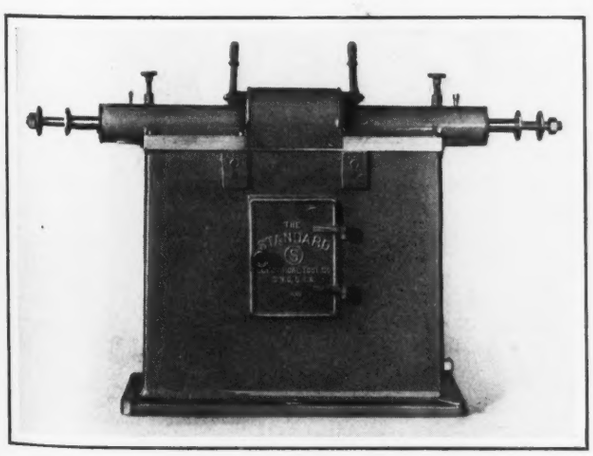
ment Co., 1202 W. Fort St., Detroit, Mich. While this vise was primarily designed for use on automatic drilling machines, it can be adapted to many kinds of drilling and milling operations performed either horizontally or vertically.

The various construction details are apparent from Figs. 1 and 2. Work is quickly locked or unlocked in the vise jaws by merely moving the outer end of the clamping handle through a distance of 2 inches. Movements of this handle are always smooth and direct without requiring hammering or pounding, and hence the vise can be readily used on machines operated by girls.

Another feature of this vise is that the flat surface locking principle used prevents the work from chattering and becoming loose. When the jaws are reground, they can be instantly adjusted for centralizing the work without resorting to the cut-and-fit method in order to hold to close limits.

STANDARD ELECTRICAL TOOL CO.'S TWO-MOTOR BUFFER AND POLISHER

The latest addition to the line of buffing and polishing equipment built by the Standard Electrical Tool Co., 1938-46 W. 8th St., Cincinnati, Ohio, is designated by the manufacturer as the "Standard Right-speed Two-motor Buffer and Polisher." The machine is made in 3-, 5- and 7 1/2-horsepower sizes. It has two motors of ball-bearing design, located in the base, each motor being mounted on a hinged plate which has an adjustable screw to take up the tension of the Dayton "Cog Belts" used for driving the spindles. These belts run in V-grooved cast-iron pulleys. Independent controls are provided for the motors.



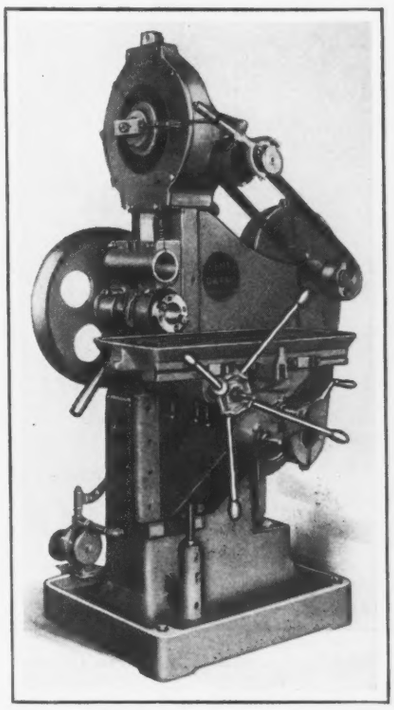
Two-motor Buffer and Polisher Built by the Standard Electrical Tool Co.

Any speed of the spindles from 2000 to 3000 revolutions per minute can be obtained by changing the motor pulleys. The spindles are made of nickel steel and are equipped with S K F ball bearings mounted in dustproof chambers and running in oil. Each spindle is fitted with a hand brake for quick stopping and also with a device for locking the shaft when changing wheels. Spindles of any length can be supplied.

The back of the machine is made of heavy sheet metal, and is hinged so that it can be easily raised to permit a full view of and access to the inside of the machine.

KENT-OWENS MILLER WITH CAM FEED

A milling machine placed on the market by the Kent-Owens Machine Co., 958 Wall St., Toledo, Ohio, is provided with a cam feed to the head that permits changes in the rate of cutter travel to suit any changes in the cross-section of the cut, thus affording maximum production. This feeding arrangement may be operated continuously or may be automatically disengaged upon the completion of a cycle. In the former case, the operator simply loads and unloads the work. An indexing fixture can be used advantageously on many jobs in order to speed up production.



Kent-Owens Miller with Cam Feed to Head

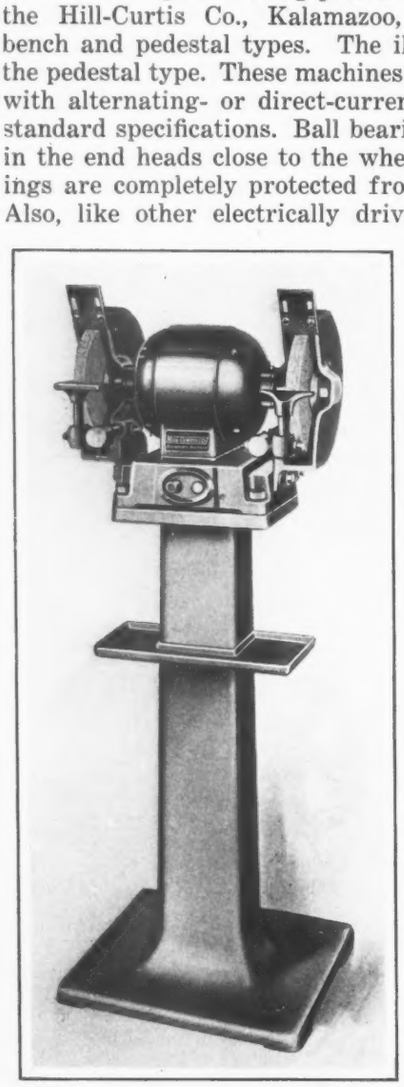
The illustration shows a machine driven by a motor mounted on the back of the column, although a countershaft drive can also be supplied. The drive from the motor to the back-shaft is through a silent chain, and both the vertical feeding mechanism and the spindle are driven by the back-shaft through belts. The back-shaft and the machine spindle are mounted in Timken tapered roller bearings. The spindle is of the standard milling machine type. It is equipped with a heavy flywheel to prevent chatter and vibration.

The cam is driven through worm-gearing, and wear between the worm and worm-wheel can be taken up by means of an eccentric bushing. Cams

can be furnished to suit any job. The table is 35 inches long by 14 inches wide, while the maximum distance from the table to the center line of the spindle is 17 1/8 inches.

HILL-CURTIS MOTOR-DRIVEN GRINDERS

Six- and eight-inch electrically driven grinders of a new design are being placed on the market by the Hill-Curtis Co., Kalamazoo, Mich., in both bench and pedestal types. The illustration shows the pedestal type. These machines may be equipped with alternating- or direct-current motors of any standard specifications. Ball bearings are mounted in the end heads close to the wheels, and all bearings are completely protected from dust and grit. Also, like other electrically driven grinding and polishing machines made by this company, there are no holes or open slots in the motor housing or end bells, and thus the windings are protected from any emery grit or dust.



Hill-Curtis Electrically Driven Grinder

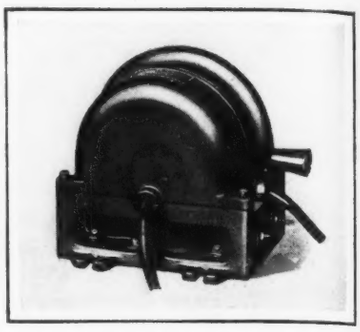
A two-pole Underwriters' approved quick make-and-break switch is standard equipment. The wheel guards and toolrests are adjustable to suit the wear of the wheels, and they can be quickly removed when necessary.

Single-phase alternating-current machines are equipped with an improved commutating-type repulsion-induction motor. One of the features that is particularly stressed regarding the single-phase machines is that low voltage has no objectionable effect. The machines can be attached to any convenient lighting-circuit outlet.

IMPROVED SWITCH FOR TAFT-PEIRCE MAGNETIC CHUCKS

An improved field discharge switch of the type illustrated has been developed by the Taft-Peirce Mfg. Co., Woonsocket, R. I., for use on the "Superpower" magnetic chucks made by this concern. These chucks were described in July, 1927, MACHINERY, page 878.

The switch has been designed to dissipate the high voltage surge induced in the windings of an unprotected circuit when the user of a magnetic chuck throws on the switch. It is pointed out that with a large chuck, this voltage surge in the coils will build up instantaneously to several times the normal operating voltage, and that although the surge is of but a moment's duration, when repeated continuously through months of use, it is likely to cause trouble by puncturing the coil insulation. With the new switch, this voltage surge is definitely limited to a harmless intensity and dissipated through resistance coils.



Switch Provided on Taft-Peirce Magnetic Chucks

The switch is designed primarily for use on chucks of high rating. It is now regular equipment on all "Superpower" chucks of size 1134 and larger, and may also be applied to chucks in use.

HUNTER HIGH-SPEED METAL CUT-OFF SAW

A No. 4 high-speed saw intended for cutting off brass, bronze, and copper shapes, as well as solid bars and tubing, with a minimum of burr, is being added to the line of sawing equipment manufactured by the Hunter Saw & Machine Co., 5662 Butler St., Pittsburgh, Pa. The circular saw employed is mounted on a balanced tilting frame, and is fed through the material by means of an off-side hand-lever. A three-horsepower motor drives the saw blade through a roller chain and sprockets. Means are provided for keeping the chain at the correct working tension.

The motor and starter are completely enclosed in the base. A quick-acting eccentric vise is furnished for clamping the work. The saw guard tilts out of the way to facilitate removal of the saw. Angular, as well as straight cuts, can be made.

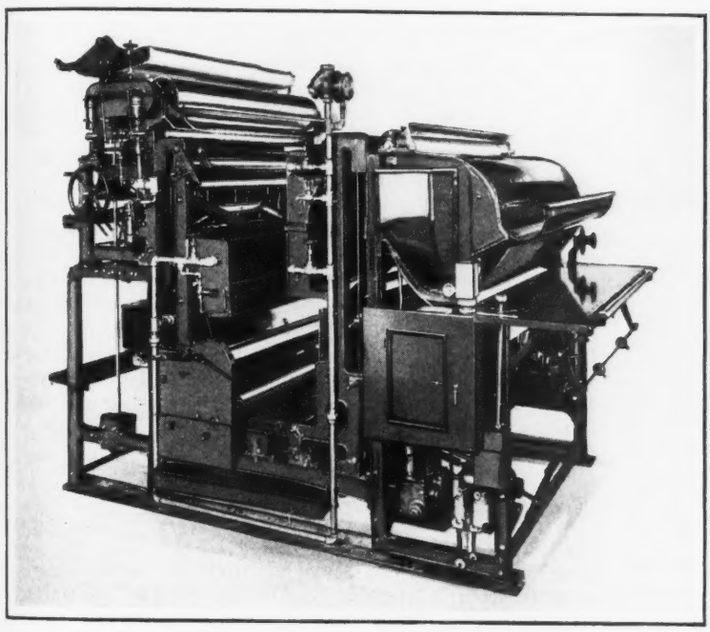
Hunter High-speed Saw for Cutting off Brass, Bronze, and Copper

The saw has a capacity for round stock up to 3 inches in diameter and over-all sections up to 5 by 1 3/4 inches. The blade is 10 inches in diameter and runs at a peripheral speed of 1300 feet per minute. The net weight of the machine with a standard motor and starter is 950 pounds.

PEASE HIGH-SPEED BLUEPRINTING MACHINE

One of the principal advantages claimed for the "Peerless Model 30" blueprinting machine now being introduced on the market by the C. F. Pease Co., 822 N. Franklin St., Chicago, Ill., is its ability to turn out high-quality prints at the rate of 12 feet per minute. The machine will produce blueprints, negative prints, and blue-line and brown-line prints. While it is operated the same as the model 20 machine, it differs greatly in design.

Following the usual practice, tracings are laid face upward on a continuous roll of paper at the front of the machine. They are carried upward around a semicircular segment of French plate glass past a bank of arc lamps. These lamps are individually mounted, in horizontal alignment, and give an intense light. After the exposure has been made, the tracings are automatically returned to the tray at the front of the machine, while the prints on the continuous roll of paper are carried through the successive operations of washing, potashing, and drying. The printed paper is then automatically rolled up in loose cylindrical form at the rear of the machine for convenient cutting and trimming.



Pease Blueprinting Machine which Runs at Speeds up to 12 Feet per Minute

The machine has a speed range of from 4 inches to 12 feet per minute. It is driven by a 1/4-horsepower variable-speed motor which is direct-connected to a fully enclosed gear-reduction unit that runs in oil. At the extreme left-hand end of the machine, and mounted in the feed table, is a special four-point automobile type of gear shift which provides two forward speeds, high and low, as well as a reverse speed and a neutral position. The reverse gear permits the operator to withdraw tracings conveniently or run back the leader roll whenever desired.

There is another speed control at the right-hand side of the machine in the form of a hand-operated dial connected through a sprocket chain to a rheostat beneath the feeding table. This regulator permits instant changes of the printing speed to conform with the character of the tracings being printed.

The dryer consists of two chromium-plated copper drums and an auxiliary air-drying unit. The printer can be operated separately from the washing and drying units, and can also be purchased separately. While the machine is particularly adapted to long-run production, it is also intended for use in drawing-rooms where single prints are made at a time. The machine is made in two sizes of 42- and 54-inch widths, respectively.

BRUSHES FOR INSIDE METAL CLEANING

Special types of cup and end brushes, designed for removing scale and sand from the interior of cored castings, polishing hollow ware, and cleaning out carbon from cylinders and valve-stem guide holes, as well as preparing interior metal surfaces for welding, have been brought out by the Specialty Mfg. Co., 10698 Berea Road, Cleveland, Ohio. These brushes may be used either on a polishing spindle or in conjunction with flexible shaft equipment, and may be made up into gangs of any desired shape of brush surface.

* * *

NON-CORROSIVE ORNAMENTAL IRON

The use of non-corrosive iron and steel for building purposes is increasing. What is known as Allegheny metal, having a silver-like finish is used for covering the pedestrian bridge that now connects the new Chicago Daily News Building with the Northwestern Terminal in Chicago. This remarkable chrome-nickel iron is practically impervious to the corrosive action of the elements and withstands the most severe weather conditions indefinitely without losing its highly polished finish. Only an occasional wiping with a damp cloth is needed to maintain the lustre. The metal was furnished by Joseph T. Ryerson & Son, Inc., Chicago, Ill. Both of the buildings mentioned also use this kind of metal in their cafeterias.

* * *

A device for automatically switching on automobile headlights has recently been developed. The instrument, which can be easily fitted to the instrument board of the car, is about the size of a speedometer and uses no current. It has a dial, graduated in time intervals of 15 minutes up to 6 hours, so arranged that the pointer may be set, by turning a small knob, for switching on the headlights after a certain period of time has elapsed from the time of setting.

PERSONALS

F. A. MERRICK was elected president of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., at a meeting of the board of directors in June. E. M. HERR, president since 1911, has resigned in order to take an extended vacation. He will continue his connection with the company as vice-chairman of the board of directors. Mr. Merrick advances to the presidency from the position of vice-president and general manager. Shortly after graduating from Lehigh University he was employed by the Steel Motors Co., a subsidiary of the Lorain Steel Co., where he was responsible for many important electrical inventions, holding the position of manager and chief engineer. When the Westinghouse organization acquired the Steel Motors Co., Mr. Merrick was selected to prepare plans for a plant in Canada, and upon the formation of the Canadian Westinghouse Co., Ltd., in 1903, was sent

F. A. Merrick, New President of the Westinghouse Electric & Mfg. Co.

A. B. Field, who was Recently Awarded the Lamme Medal

to Canada as superintendent of the company. He subsequently became manager of works and vice-president and general manager. He will be located in Pittsburgh.

ALLAN BERTRAM FIELD, a prominent English inventor and consulting engineer for the Metropolitan Vickers Electrical Co., Ltd., of Manchester, England, was presented with the first Benjamin G. Lamme Medal on June 26 at Swampscott, Mass. The Lamme Medal was created by provisions in the will of the late Benjamin G. Lamme, electrical scientist and chief engineer of the Westinghouse Electric & Mfg. Co. It is given for meritorious achievement in the design of electrical machinery. The recipient is chosen by the Lamme Medal Committee of the American Institute of Electrical Engineers. The specific accomplishment for which Mr. Field was awarded the medal is the mathematical and experimental investigation of eddy current losses in large slot-wound conductors in electrical machinery.

S. M. ALBERTSON, formerly of the Central Specialty Co., Detroit, Mich., has joined the Bantam Ball Bearing Co., South Bend, Ind., as contact engineer.

HENRY E. REA, formerly assistant sales manager of Pittsburgh Gear & Machine Co., Pittsburgh, Pa., has recently been promoted to the position of assistant treasurer.

F. D. KAMERER has been appointed auditor of disbursements of the General Electric Co., Schenectady, N. Y., to succeed GEORGE F. MOSHER, recently elected assistant treasurer.

J. H. JACKSON, sales manager of the Pittsburgh Gear & Machine Co., Pittsburgh, Pa., has recently been made secretary of the company, but will continue to handle sales as his major duty.

E. F. TALMADGE, formerly connected with the Halcomb Steel Co. at Cleveland, has become associated with the Timken Steel & Tube Co., 360 N. Michigan Ave., Chicago, Ill., as district sales manager.

J. P. ARMSTRONG, Balboa Building, San Francisco, Calif., has taken over the management of the Metal Stampings Contract Division of Geuder, Paeschke & Frey Co., Milwaukee, Wis., for the state of California.

STANLEY J. JACKSON has recently been promoted to the general superintendency of the Pittsburgh Gear & Machine Co., Pittsburgh, Pa., in place of his father, JOHN J. JACKSON, who retains his title of vice-president and has now become a director.

R. W. PROCTER, formerly with the Black & Decker Mfg. Co., Towson Heights, Baltimore, Md., has been appointed general sales manager of the Van Dorn Electric Tool Co., Cleveland, Ohio. Mr. Procter succeeds LYMAN H. BELLOWS, who recently resigned.

J. M. BEGGS has been placed in charge of the advertising department of the Van Dorn Electric Tool Co., Cleveland, Ohio. Mr. Beggs was formerly connected with the sales department. He will make his headquarters at the home office in Cleveland.

O. H. ESCHHOLZ has been appointed manager of the patent department of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., succeeding O. S. SCHAIRER, who has taken a similar position with the Radio Corporation of America. Mr. Eschholz's headquarters will be at East Pittsburgh.

JOHN W. TAMBERT, who for nearly five years has been in charge of the cost and manufacturing departments of the Perfex Corporation, Milwaukee, Wis., manufacturer of heavy-duty radiators, has been made secretary and treasurer of this company, succeeding C. G. PHELPS, who recently resigned.

F. L. REYNOLDS has been appointed district representative for the Allen-Bradley Co., 499 Clinton St., Milwaukee, Wis., manufacturer of electric controlling apparatus. Mr. Reynolds will look after the western Michigan territory and will have his headquarters at 4143 Ellsworth Ave., Grand Rapids, Mich.

R. C. BRAND has been appointed director of sales in the oil industry for the Union Chain & Mfg. Co., Sandusky, Ohio, manufacturer of power transmission, elevating, and conveying chains. Mr. Brand will be located at Sandusky, and will concentrate his efforts on the new Union A.P.I. chain recently developed by the company.

WARREN C. WEBB has been appointed Pacific Coast sales manager for the W. A. Jones Foundry & Machine Co., Chicago, Ill., manufacturer of speed reducers, gears, pulleys, flexible couplings, and other products. Mr. Webb was formerly Chicago sales manager of the company. His headquarters will be at 443 E. Third St., Los Angeles, Cal.

ROLLIN J. SCHENK has been appointed district manager of the Chicago office of the Hartford Steel Ball Co., Hartford, Conn., manufacturer of steel balls for bearings. Mr. Schenk's headquarters will be at 180 W. Washington St., Room 900, Chicago, Ill. The district covered by the Chicago office includes Illinois, Indiana, Iowa, Michigan, Minnesota, Missouri, and Wisconsin.

WILLIAM G. MARSHALL, since 1926 director of personnel for the Philadelphia Co. and affiliated corporations, has been made assistant to vice-president T. P. Gaylord of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Mr. Marshall will be in charge of employe relations, but no change will be made in the position of director of personnel or manager of employes service.

JOSEPH SLEPIAN, research engineer of the Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa., was given an award for the best theoretical paper presented before the American Institute of Electrical Engineers during 1928 and the first half of 1929. The award was made at the recent convention of the association at Swampscott, Mass. Dr. Slepian's prize-winning paper was entitled "The Extinction of an Alternating-current Arc."

W. W. MUMMA, sales manager of Robbins & Myers, Inc., Springfield, Ohio, has severed his connection with the company. Mr. Mumma has not yet made an announcement of his future plans, but it is understood that he expects to establish a business of his own in Springfield. He has been associated with the electric fan business almost from the very beginning of the industry, and has been active in the fan motor section of the National Electrical Manufacturers Association since its organization in 1916. Mr. Mumma's duties as fan sales manager of Robbins & Myers, Inc., will be taken over by C. H. CLARK, merchandising manager of the company.

H. R. SMALLMAN, for the last three years assistant to the sales manager of the Hanson-Van Winkle-Munning Co., Matawan, N. J., has been made manager of the Chicago office, with headquarters at 549 W. Washington Blvd. H. M. CHERRY, who has represented the company in Michigan for the last seven years, has been made manager of the Detroit office, with headquarters at 5415 Twelfth St. LOUIS M. HAGUE, who has represented the company in western Pennsylvania for the last two years, has been made manager of the Pittsburgh-

Cleveland office, with headquarters at 106 Liberty Ave., Pittsburgh, Pa. Mr. Hague's territory will comprise Ohio, western Pennsylvania, and West Virginia.

R. C. BROWER has been promoted from the position of general manager of the Timken Roller Bearing Service & Sales Co., Canton, Ohio, to assistant secretary and assistant treasurer of the Timken Roller Bearing Co. W. H. RICHARDSON, formerly manager of the New York branch of the Timken Roller Bearing Service & Sales Co., has been made general manager of the company, with headquarters in Canton. E. H. AUSTIN, manager of the Kansas City branch, becomes manager of the New York branch; and L. J. HALDERMAN, manager of the Atlanta, Ga., branch, has been made manager at Kansas City. PARKER T. ANCARROW, manager of the Richmond, Va., branch, becomes manager at Atlanta, and STEWART B. ANCARROW becomes manager of the Richmond branch.

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TRADE NOTES

MAGNETIC MFG. CO., Milwaukee, Wis., has appointed Wells Fargo & Co. S. A., Mexico D. F., exclusive representative for the Republic of Mexico, with A. J. Hiern as manager.

BOSTON GEAR WORKS SALES CO., Norfolk Downs (Quincy), Mass., announces that the Cleveland branch of the company is now located at 211 St. Clair Ave., N.W., Cleveland, Ohio.

DEMCO DRILLING MACHINE CO., DIVISION OF MERIT EQUIPMENT CORPORATION, 6616 Morgan Ave., Cleveland, Ohio, is erecting an addition, 50 by 100 feet, to its plant. The new building will be of steel construction.

PORTER-CABLE MACHINE CO., Salina and Wolf Sts., Syracuse, N. Y., has purchased and will continue to manufacture the Emmert oscillating spindle sander formerly manufactured by the Emmert Mfg. Co., Waynesboro, Pa.

UNION CHAIN & MFG. CO., Sandusky, Ohio, has opened a St. Louis office at Third and Plum Sts., with Hugh Scott in charge. An office has also been opened at 1535 Naomi St., Indianapolis, Ind., of which A. R. Young will be in charge.

BANTAM BALL BEARING CO. of Connecticut held a stockholders' meeting at Bantam, Conn., July 1, at which it was decided to dissolve the Connecticut company and sell the plant at Bantam, so as to concentrate their efforts in the Indiana company at South Bend.

BOWERS TOOL & DIE CO., 610-614 W. Willard St., Kalamazoo, Mich., was organized some time ago for the designing and building of special tools, dies, and machinery. The company has just made an increase in its manufacturing facilities and added new equipment. Plans are under way for doubling the capacity of the plant next year.

PREST-O-LITE CO., INC., 30 E. 42nd St., New York City, announces that the company has added two new acetylene gas plants, one located at 540 E. 17th St., Wichita, Kans., and one at Jones St. and Pennsylvania Railroad, Youngstown, Ohio. These plants will supply the local industry with acetylene for oxy-acetylene welding and cutting.

FUSION WELDING CORPORATION, a subsidiary of the CHICAGO STEEL & WIRE CO., 103rd St. and Torrence Ave., Chicago, Ill., has taken over the sale of all the welding rod manufactured by the parent company. The change provides one source of supply for both Weldite welding rods and Fuzon welding equipment and accessories previously sold by the two companies.

MILWAUKEE CIRCULATING PUMP & MFG. CO., 331 Ninth St., Milwaukee, Wis., has changed its name to the HEIN-WERNER MOTOR PARTS CORPORATION. The company will remain at its present location until September 15, after which it will move into a new building now under construction at Waukesha, Wis. The new building will afford a floor space of 45,000 square feet.

SURFACE COMBUSTION CO., Toledo, Ohio, in order to take care of its increasing business in gas burners and gas-fired furnaces for industrial purposes, has found it necessary to add to its plant a shop with 35,000 square feet of floor area which, when completed, will give a combined floor area of 90,000 square feet. This includes office, laboratory, factory, and storage rooms.

EX-CELL-O TOOL & MFG. CO., 1238 Oakman Blvd., Detroit, Mich., announces that because of the large increase in its aviation parts business, the name of the company will be changed to EX-CELL-O AIRCRAFT & TOOL CORPORATION. In order to take care of the rapidly increasing business, an expansion program is planned, which will entail the building of a large addition to the present plant.

MOSSBERG PRESSED STEEL CORPORATION, Attleboro, Mass., after having been operating on a day-and-night schedule for many months, has found it necessary to enlarge the company's plant and provide additional equipment to take care of the increasing business. The additional facilities, which will be in operation some time in August, will enable the company to practically double its output.

NEWHALL CHAIN FORGE & IRON CO., 9-15 Park Place, New York City, has purchased the chain shop and other buildings of the Rensselaer Chain Works at Rensselaer, N. Y. The Rensselaer chain shop is equipped particularly for the manufacture of the better grades of hand-made heavy-duty chains, and has been under the exclusive operation of the Newhall Chain Forge & Iron Co. for a number of years.

SURFACE COMBUSTION CO., Toledo, Ohio, announces the opening of a district sales office in Kansas City in charge of W. H. Kay, who has been with the company for several years, first in the erection department and later in the estimating and sales departments. The territory covered by the Kansas City office consists of Kansas, Nebraska, Wyoming, Colorado, Utah, a portion of Texas, and Missouri, with the exception of St. Louis.

AMERICAN PULLEY CO., 4200 Wissahickon Ave., Philadelphia, Pa., manufacturer and distributor of American steel split pulleys, pressed-steel hangers, and pressed-steel hand trucks, has taken over all products of the SPRUCOLITE CORPORATION, Bloomfield, N. J. This new line, which will be known as American Sprucolite pulleys, comprises standard and special motor pulleys; machine and shafting pulleys; V-belt pulleys; flange pulleys; taper and step cone pulleys; multi-crown pulleys; rolls, drums, and friction fillers.

KRUPP NIROSTA CO., INC., announces through its president, H. G. Batcheller, that Henry Disston & Sons, Inc., Philadelphia, Pa., and Wallingford Steel Co., Wallingford, Conn., have been licensed to roll Nirosta steel into strip form under the Krupp Nirosta patents. The Krupp Nirosta Co., Inc., recently acquired the Johnson patents from the Crucible Steel Co. of America, and has included in the contracts with its licensees the right to manufacture, under these patents, the alloy known as "Resistal."

HEALD MACHINE CO., Worcester, Mass., builder of grinding machines and magnetic chucks, has under construction an addition to the company's factory. The new part, 105 feet wide by 360 feet long, will be of steel and brick construction with a sawtooth roof. It will house the offices, tool-room, and experimental and service departments. The present buildings will be devoted entirely to manufacturing purposes. The additional space was especially required to handle the increasing business in automatic internal grinding machines.

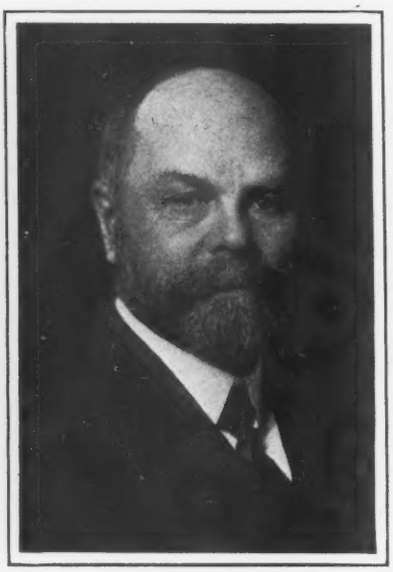
TRANSMISSION ENGINEERING CO., Philadelphia, Pa., is a new organization formed for the purpose of specializing in power transmission problems. The company will devote its entire time to securing data on the most economical methods of mechanically transmitting power. Their engineers will be available to manufacturers who have transmission problems of any kind. L. H. Shingle, the founder of the company, was active in organizing the Power Transmission Association, and has been treasurer of that organization since its formation.

YALE & TOWNE MFG. CO., Stamford, Conn., has purchased the assets and goodwill of the STUEBING COWAN CO., Cincinnati, Ohio, manufacturer of hand lift trucks. The sales of the entire line of Yale & Towne material handling devices will continue to be under the supervision of James C. Morgan. The executive personnel of the Stuebing Cowan Co. will become connected with the Yale & Towne Mfg. Co., Walter C. Stuebing acting as assistant to Mr. Morgan, in charge of all truck sales, and William Stuebing continuing to act as superintendent of the plant at Cincinnati. A large modern factory for the manufacture of hand lift trucks and skid platforms is in process of construction at Cincinnati, as mentioned in July MACHINERY.

OBITUARIES

WORCESTER R. WARNER

Worcester Reed Warner of Tarrytown-on-Hudson, N. Y., who with Ambrose Swasey founded the Warner & Swasey Co., Cleveland, Ohio, died at Eisenach, Germany, June 25. Mr. Warner was born at Cummington, Mass., May 16, 1846. He spent his boyhood on his father's farm. At the age of nineteen he went to Boston to learn drafting in the office of George B. Brayton. Later in the same year he went to Exeter, N. H., to learn the machinist's trade at the Exeter Machine Co. There he met Ambrose Swasey, with whom he was destined to be associated for more than sixty years.



In 1870, together with Mr. Swasey, Mr. Warner moved to Hartford, Conn., and entered the employ of the Pratt & Whitney Co. There he remained until 1880, in charge of one of the machine-building departments. He also had charge of the company's exhibition at Boston and was manager of its exhibit at the Centennial Exhibition in Philadelphia in 1876. His friendly personality was throughout his life one of his outstanding characteristics and aided him greatly in his earlier years. He was deeply interested in engineering subjects and especially in the study of astronomy.

In 1880 Mr. Warner and Mr. Swasey went to Chicago to found a business for themselves, but discovering that they were too far west for that early period in machine tool building, they moved to Cleveland, Ohio, in 1881, where they built a shop on the site on which the Warner & Swasey Co. has been established for nearly fifty years. The new company soon became known as a builder of high-grade machine tools and special machinery, and due to Mr. Warner's interest in astronomy, also became known for the design and construction of telescopes and other instruments for observatories.

The 36-inch refractor at the Lick Observatory and the 40-inch refractor at Yerkes Observatory are still the largest refracting telescopes ever built. The 60-inch reflecting telescopes for the Argentine National Observatory and for the Ohio Wesleyan University, and the 72-inch reflector at the Dominion Astrophysical Observatory are surpassed in size only by the 100-inch Hooker telescope at Mt. Wilson, Calif.

While Mr. Warner's interest in astronomy brought about the building of these great instruments which attracted world-wide attention, the company became equally well known in the mechanical field as a builder of a complete line of turret lathes—in fact, turret lathes have always formed the solid base upon which the company's success has rested.

Mr. Warner was a member of the British Astronomical Society, the American Astronomical Society, and the American Association for the Advancement of Science. He was at one time president of the American Society of Mechanical Engineers and of the Civil Engineers Club of Cleveland. He was a fellow of the Royal Astronomical Society, and held the unusual degree of Doctor of Mechanical Science. He was a trustee of the Case School of Applied Science, Adelbert College, Western Reserve University, and the Cleveland School of Art. He was also a director of the Guardian Trust Co. and the Society for Savings of Cleveland, and a member of the advisory board of the Cleveland Museum of Art.

Mr. Warner practically retired from business in 1911, when he moved from Cleveland to Tarrytown-on-Hudson, N. Y., but he kept up his active interest in the affairs of the company and also had wide interests in philanthropic and educational fields. In 1890, Mr. Warner married Cornelia Fraley Blakemore of Philadelphia, who survives him. He is also survived by a daughter, Miss Helen Blakemore Warner.

WILLIAM SYMES ANDREWS, for many years connected with the electrical industry, died at his home in Schenectady July 1. Mr. Andrews was the oldest employe in the organization of the General Electric Co., his service to electric lighting being unbroken from the day he entered Edison's employ in the autumn of 1879 before the General Electric Co. came into existence. His death was directly traceable to the effects of X-ray burns sustained through a prolonged period of investigation thirty-five years ago, when X-rays were so new to science that their dangerous properties in case of long exposure to them were not understood.

Mr. Andrews was born at Saltford, England, September 10, 1847. He went to Toronto in 1875, and in 1877 came to the United States, settling in Newark, N. J. In 1879 he entered Edison's employ, installing the Edison lighting system in many cities. He became manager of central station sales with the General Electric Co., at Schenectady, in 1894, and in 1907 became electric lighting engineer of the company in Schenectady and Pittsfield. In 1913 he was appointed a consulting engineer. Mr. Andrews was a member of numerous engineering and scientific societies.

OLIVER AMES, senior member of the board of directors of the General Electric Co., Schenectady, N. Y., died at his home in North Easton, Mass., on June 18, aged sixty-five years. Mr. Ames had been a member of the board since 1893, being elected at that time to fill the vacancy caused by the death of his father, who previous to the formation of the General Electric Co. was a director of the Thomson-Houston Co.

JOSEPH HAMMELE, director, sales manager, and for many years an associate of the Bausch & Lomb Optical Co., 662 St. Paul St., Rochester, N. Y., died on July 2.

GRINDING INTERNAL SPLINES

A grinding wheel driven by a minute turbine at the factory of Adolphe Saurer at Arbon, Switzerland, where high-grade commercial vehicles are being manufactured, was described in the *Automobile Engineer*. There is now little difficulty in producing accurately ground splined shafts, but the value of the accuracy thus obtained may be reduced by inaccuracies in making internal splines. The method referred to has been devised for grinding the sides of the splines in transmission gears.

A small cup-shaped grinding wheel is mounted on an arbor, together with a small disk with integral turbine blades. A jet of water, under pressure ranging from 140 to 350 pounds per square inch, is directed tangentially upon the blades from a pipe in the shank of the tool. The whole assembly must be small enough to enter the bore of the gear to be ground. This turbine develops power enough to grind both sides of the splines, which are previously broached with a slight clearance at the top.

In general appearance, the machine on which this grinding head is used resembles a small boring mill. The gear to be ground is mounted on the table of the machine, which is provided with an indexing mechanism and a slight lateral movement to apply the cut. The grinding wheel is carried in a spindle head that is moved up and down by means of a handwheel during the actual grinding.

Water under pressure is supplied by a gear pump at the rear of the machine, driven by a large belt. The wheel-spindle bearings are not injured by loose abrasive, since this is continually washed away by the waste water from the turbine wheel.

* * *

The June production of automobiles reached over 536,000 cars, trucks, and buses, according to the National Automobile Chamber of Commerce. A new record for the production in any six-month period was established during the first six months of 1929, with a total output of 3,380,000 cars and trucks. This exceeds the output during the same period in 1928 by 1,053,000 vehicles. The output in June was nearly 100,000 cars less than in May, and a seasonal decline is now expected following the high pace set by the industry during the first six months of the year.

COMING EVENTS

AUGUST 20-28—Fifth Annual Industrial Leadership Course at Silver Bay, Lake George, N. Y., under the auspices of the Industrial Department of the National Council of Young Men's Christian Associations, 347 Madison Ave., New York City.

AUGUST 26-28—Aeronautic meeting of the Society of Automotive Engineers at the Hollenden Hotel, Cleveland, Ohio. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

AUGUST 28-SEPTEMBER 1—Twelfth annual conference on Human Relations in Industry at Silver Bay, Lake George, N. Y., under the auspices of the Industrial Department of the National Council of Young Men's Christian Associations, 347 Madison Ave., New York City.

SEPTEMBER 9-11—Fall meeting of the Institute of Metals Division, American Institute of Mining and Metallurgical Engineers in Cleveland, Ohio. W. M. Corse, secretary, 810 Eighteenth St., N.W., Washington, D. C.

SEPTEMBER 9-12—Fall meeting of the American Welding Society in Cleveland, Ohio. M. M. Kelly, secretary, 33 W. 39th St., New York City.

SEPTEMBER 9-12—Fall meeting of the Iron and Steel Division, American Institute of Mining and Metallurgical Engineers in Cleveland, Ohio. H. Foster Bain, secretary, 29 W. 39th St., New York City.

SEPTEMBER 9-13—Annual convention of the American Society for Steel Treating at Cleveland, Ohio. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

SEPTEMBER 9-13—National Metals Congress in Cleveland, Ohio. Simultaneous meetings with the American Welding Society; Institute of Metals Division, American Institute of Mining and Metallurgical Engineers; Iron and Steel Division, American Society of Mechanical Engineers; Iron and Steel Division, American Institute of Mining and Metallurgical Engineers; and American Society for Steel Treating.

SEPTEMBER 9-13—Eleventh National Metal Exposition under the auspices of the American Society for Steel Treating at the Cleveland Public Auditorium, Cleveland, Ohio. For further information, address W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

SEPTEMBER 11-13—Fall meeting of the Iron and Steel Division, American Society of Mechanical Engineers in Cleveland, Ohio. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SEPTEMBER 19—Meeting of the Electric Hoist Manufacturers Association in New York City. Secretary, E. Donald Tolles, 165 Broadway, New York City.

SEPTEMBER 30-OCTOBER 2—Eighth annual convention of the National Industrial Advertisers Association in Cincinnati, Ohio. Chairman of the Convention Committee, Jesse R. Harlan, advertising and sales manager of the Stuebing-Cowan Co., Cincinnati, Ohio.

SEPTEMBER 30-OCTOBER 4—Machine Tool Exposition held by the National Machine Tool Builders' Association in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, 1415 Enquirer Building, Cincinnati, Ohio.

SEPTEMBER 30-OCTOBER 4—Machine Tool Congress to be held in Cleveland, Ohio, jointly with the Production Meeting of the Society of Automotive Engineers and the Machine Shop Practice Division Meeting of the American Society of Mechanical Engineers. For further information, address E. F. DuBrul, National Machine Tool Builders' Association, 1415 Enquirer Building, Cincinnati, Ohio.

OCTOBER 2-4—Production meeting of the Society of Automotive Engineers to be held at Hotel Cleveland, Cleveland, Ohio. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

OCTOBER 7-10—Annual meeting of the National Electrical Manufacturers Association at the Wardman Park Hotel, Washington, D. C. For further information, address Albert Pfaltz, National Electrical Manufacturers Association, 420 Lexington Ave., New York City.

OCTOBER 7-12—First National Electrical Exposition to be held at the Grand Central Palace, New York City, under the joint auspices of the Electrical Board of Trade of New York and the New York Electric League. For further information, address E. F. Korbel, 441 Lexington Ave., New York City.

OCTOBER 24-26—Semi-annual meeting of the American Gear Manufacturers' Association at Briarcliff Lodge, Briarcliff Manor, N. Y. T. W. Owen, Secretary, 3608 Euclid Ave., Cleveland, Ohio.

DECEMBER 2-6—Annual meeting of the American Society of Mechanical Engineers at the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

NEW BOOKS AND PAMPHLETS

ROLLING MILL ROLLS. A bibliography by Victor S. Polansky. 59 pages, 5 by 7 inches. Distributed by the Carnegie Library of Pittsburgh, Pittsburgh, Pa.

ROLLING TESTS OF PLATES. By Wilbur M. Wilson. 60 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 191 of the Engineering Experiment Station. Price, 30 cents.

INVESTIGATION OF HEATING ROOMS WITH DIRECT STEAM RADIATORS EQUIPPED WITH ENCLOSURES AND SHIELDS. By Arthur C. Willard, Alonzo P. Kratz, Maurice K. Fahnestock, and Seichi Konzo. 72 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 192 of the Engineering Experiment Station. Price, 40 cents.

FORMULAS IN GEARING. 265 pages. Published by the Brown & Sharpe Mfg. Co., Providence, R. I. Price, $1.50.

This is a revision of a book dealing with gearing formulas. Considerable new material has been added in the new edition, including calculations for long and short addendum for spur gears and stub tooth gears; data on generated straight tooth and spiral bevel gears, using the Gleason Works system; strength of both metallic and non-metallic gears, including outline factors for 14 1/2- and 20-degree pressure angles and 20-degree stub tooth gears, based on the diametral and circular pitches; diagrams for the solution of right-angle and oblique-angle triangles; and logarithms for gear ratios from 24/100 to 100/24, inclusive.

X-RAYS IN INDUSTRY. 60 pages, 5 1/2 by 8 1/2 inches. Distributed by the Eastman Kodak Co., Rochester, N. Y.

X-ray photography is being increasingly used to determine the internal structure of inanimate objects. Steel castings, aluminum castings, metal radio transmission tubes, and a variety of other metal objects have been subjected to X-ray examination, and such examination has become standard practice in some factories. The principal work along these lines has been done in the Watertown Arsenal, the Massachusetts Institute of Technology, and the Woolwich Arsenal in England. This information, as part of a brief survey of the theory and use of X-rays in industry, is included in this booklet. The booklet should stimulate manufacturers to visualize many applications of radiography peculiar to their own business.

ENGINEERING INDEX FOR 1928 (Two Volumes). 2000 pages, 7 3/4 by 10 1/2 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City. Price, one hundred twenty-five dollars.

This work is an outgrowth of an engineering index that has been issued annually for the last forty-five years and that has come to be recognized as an authentic guide to periodical technical literature. The present index, however, differs radically from preceding ones in that it is far more comprehensive. It has been extended in scope to include every branch of engineering in seventeen languages, and may be said to be the first encyclopedic bibliography of periodical engineering literature ever published. The work contains a classified list of articles appearing in the technical press throughout the world during the year 1928. The present edition includes 75,000 reference items covering 1700 periodicals. These items are all accurately classified under alphabetically arranged subheadings and carefully cross-indexed, the material being so voluminous that it requires two books of 1000 pages each. A sufficient description of the article is given in each case for the reader to obtain an adequate conception regarding its probable value for his purpose. The name, date, and address of the publication in which the article appeared are also given. A new feature of the present edition is an authors' index. In its present comprehensive form, this work should be an invaluable guide for use in public and corporation libraries, government departments, industrial organizations, and educational institutions.

REPORT OF THE NATIONAL SCREW THREAD COMMISSION. 261 pages, 6 by 9 inches. Published by the United States Department of Commerce, Miscellaneous Publication, Bureau of Standards, No. 89. Price, 50 cents. (Copies may be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C.)

This is the third report of the National Screw Thread Commission, and it is a revision made in 1928 of the 1924 report. A number of important revisions have been made in the American National (formerly National) Screw Thread Series, including additional data and the substitution of tables of specific pitch-diameter tolerances for threads of special diameters, pitches, and lengths of engagement, in place of the method of determining such tolerances by adding together increments. The specifications for threading tools have been revised extensively. There is considerable new material, such as the American National bolt and nut proportions; screw threads for oil-well drilling equipment, including pipe, casing, line pipe, and other specifications published by the American Petroleum Institute; standard hose connections for welding and cutting torches; rolled threads for screw shells for electric sockets and lamp bases; standard designs of plain and threaded plug and ring gages; common practice as to the thread series and classes of fits for different applications of screws, bolts, and nuts; and an outline of standard practice for Acme screw threads. This outline of practice gives general specifications, the classification of fits, and tables and formulas for allowance and tolerance values, and is followed by specifications and data for Acme thread gages. Tools for producing Acme screw threads are dealt with in the appendix, where dimensions and tolerances for Acme taps are also given. This report is illustrated throughout by drawings wherever needed, and it gives most of the data in tabular form.

NEW CATALOGUES AND CIRCULARS

PULLEYS. T. B. Wood's Sons Co., Chambersburg, Pa. Bulletin 272, containing data on ball-bearing loose pulleys.

ELECTRIC STARTERS. Lincoln Electric Co., Cleveland, Ohio. Circular descriptive of Lincoln "Across-line" safety starters.

LIGHTING EQUIPMENT. Crouse-Hinds Co., Syracuse, N. Y. Bulletin 2134, descriptive of a new floodlight for universal service.

STEEL CASTINGS. Lebanon Steel Foundry, Lebanon, Pa. Circular illustrating the use of Lebanon steel castings in motor mowers and lawn tractors.

ELECTRIC STARTERS. Electric Controller & Mfg. Co., Cleveland, Ohio. Circular illustrating a variety of applications of E. C. & M. automatic synchronous motor starters.

HARDENING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Pamphlet No. 19 in a heat-treating series, dealing with the hardening of tools by the Hump method.

MONEL METAL AND NICKEL. International Nickel Co., Inc., 67 Wall St., New York City. Pamphlet containing instructions for welding, brazing, and soldering Monel Metal and pure nickel.

AUTOMATIC WIRE-FORMING MACHINERY. Baird Machine Co., Bridgeport, Conn. Circular illustrating Baird automatic wire-forming machines, presses, and horizontal chucking machines.

BAROMETER AND VACUUM RECORDER FOR STEAM TURBINES. Uehling Instrument Co., 473 Getty Ave., Paterson, N. J. Bulletin 150, describing the Uehling combined barometer and vacuum recorder for steam turbines.

ELECTRICAL HEATING EQUIPMENT. General Electric Co., Schenectady, N. Y. Pamphlet illustrating and describing GE industrial heating devices, including soldering irons, glue pots, immersion heaters, cartridge units, melting pots, electric furnaces, etc.

ROLLED ZINC. New Jersey Zinc Co., 160 Front St., New York City. Pamphlet dealing with rolled zinc. Among the subjects covered are rolling mill tolerances, methods of testing, fabrication of rolled zinc, soldering, painting, finishes, physical properties, and uses.

FLEXIBLE COUPLINGS. Brown Engineering Co., 133 N. 3rd St., Reading, Pa. Bulletin 28, describing the constructional features of "Kanti-Lever" flexible couplings. The bulletin also contains prices and dimensions, as well as information on how to select couplings.

BUTT-WELDING MACHINES. Federal Machine & Welder Co., Dana Ave., Warren, Ohio. Bulletin 60, describing the construction and advantages of Federal butt-welding machines. Typical examples of the class of work handled on these machines are illustrated.

AIR COMPRESSORS. Allen Air Appliance Co., Inc., Grand Central Terminal, 452 Lexington Ave., New York City. Circular treating of the mechanical characteristics of Triple A centrifugal air compressors, and their application in various classes of service. Tables of sizes and capacities are included.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Sheets for loose-leaf catalogue, dealing with the advantages of ball bearings in general machinery application, and containing tables giving principal dimensions and load ratings of single-row bearings, double-row bearings, and radax bearings.

WELDING MACHINES. Acme Electric Welder Co., 5621A Pacific Blvd., Los Angeles, Calif., is distributing a series of bulletins entitled "The Acme of Metal Joinery," describing the different groups of Acme "hot spot" welding machines, which are made in styles suitable both for light and heavy-duty service.

PULLEYS. Henry Lindahl Foundry & Machine Co., 5900 Ogden Ave., Chicago, Ill. Catalogue 22, covering the complete line of Lindahl pulleys. The catalogue gives dimensions and prices of machine molded pulleys, ball-bearing loose pulleys, steel and wood split pulleys, paper pulleys, wire rope hoisting sheaves, belt pulleys, etc.

MAGNETIC SEPARATORS. Magnetic Mfg. Co., Milwaukee, Wis. Bulletin 90, devoted to the magnetic separation of flour, feed, cereal, cotton seed, pulverized coal, lime, gypsum, and other materials of a similar nature. The bulletin shows a number of types and designs of machines especially adapted for use where dust prevention is necessary and fire hazards are encountered.

ELECTRIC EQUIPMENT. Electric Controller & Mfg. Co., Cleveland, Ohio. Bulletins 970, 1010, 1021, and 1037-D, describing, respectively, controllers for alternating-current slip-ring motors, solenoids for direct current, crane switchboards for direct-current motors, and limit stops for alternating- and direct-current motors. A price sheet accompanies each of these bulletins.

GEAR INSPECTION MACHINE. Fellows Gear Shaper Co., Springfield, Vt. Booklet descriptive of the "Red Liner," a machine for charting automatically a permanent record of errors in gears under conditions closely approaching those of actual operation. The machine is described in detail, and a number of characteristic charts are reproduced, showing errors in gears which have been tested with this machine.

PLATING EQUIPMENT. Hanson-Van Winkle-Munning Co., 109 Church St., Matawan, N. J. Bulletins A-103, B-101, E-515, M-100, M-101, and M-103, illustrating and describing, respectively, Hanson-Munning anodes for electroplating; buffs, compositions, and cleaners; low-voltage generators for electroplating and similar uses; Optimus type E plating barrels; oblique and jewelers' plating barrels; and semi-automatic plating conveyors.

MATERIAL HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating the use of Cleveland tramrail systems for transporting bales under all sorts of conditions. Circular illustrating the use of the Cleveland tramrail system on foundry handling jobs. Circular showing the application of the Cleveland tramrail system in handling flasks, patterns, cores, and molds.

LATHES. South Bend Lathe Works, 746 E. Madison St., South Bend, Ind. New general catalogue No. 90-A, containing illustrations, descriptions, and prices of the entire South Bend line of lathes from the 9-inch to the 18-inch size. Several new models are shown in the present edition, and a number of new lathe attachments are also shown for the first time. A section is devoted to the new model tool-room precision lathe, which is built in sizes of from 11 to 18 inches.

SILENT CHAIN DRIVES. Ramsey Chain Co., Inc., 1039 Broadway, Albany, N. Y. Catalogue 628, on Ramsey silent chain drives. Following a description of the mechanical features, an outline is given of the field of application, illustrated by numerous halftones showing the use of these drives in a wide variety of industries. The last part of the book contains general data, including tables of chain speeds, standard hub diameters, chain lengths, tables of sprockets, etc.

ELECTRICAL EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletins GEA 86A, 394A, 722A, 782A, 874D, 875D, 904B, 970A, 1104, 1105, 1125, 1138, and 1142, illustrating and describing, respectively, single-phase directional over-current relays; induction motor-generator sets; Selsyns for remote signaling, control, and indication; outdoor station equipment; type WD-200A arc welder; type WD-300A arc welder; single-stage centrifugal air compressors for cupola blowing; type PQ relays; motor drive for metal-working machinery; under-voltage devices for oil circuit-breakers; GE arc-welding school; self-contained pillars; type EW resistors for mine and industrial haulage locomotives.

ELECTRIC EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet 20,388, describing the new line of Class 12-700 type A reversing drum controllers for wound rotor induction motors. Folder 5179, descriptive of the many features of Westinghouse steel panels for switchboards. Folder 5181, entitled "Quality Switchboards," outlining the important advantages of steel switchboards and the distinctive features of Westinghouse switchboards. Folder 5188, illustrating and describing the Westinghouse direct-current totally enclosed fan-cooled type SK motor, for use where the motor must be protected from dust, fumes, or abrasive material. Special publication 1842, descriptive of line-starters and line-start motors.

DIAMONDS USED AS CUTTING TOOLS

Tools pointed with diamonds have been regularly used in the past for dressing grinding wheels and for cutting hardened steel and other materials that were too hard to be cut by steel tools. It is a more recent discovery that diamond tools can be used economically in machining a number of softer materials, particularly those on which steel tools do not have a satisfactory life. The *S. A. E. Journal* calls attention to the fact that among the materials most commonly considered suitable to be machined with diamond tools today are hard rubber, vulcanized fiber, ebonite, vulcanite, mica, "felt" paper rolls, bronze, bearing metals, aluminum, copper, monel metal, and malleable iron. All these materials are more severe in their effects on steel turning tools than their hardness and tenacity would indicate, and it is difficult to obtain a smooth finish on them with a steel tool.

The diamond tool can be run at such a high speed that it is practicable to take a very fine cut; this, with a marked freedom from tearing effect, makes it possible to obtain a smoothness of finish that can be produced by no other method of machining. In turning aluminum, copper, and malleable iron, the diamond tool does not tear the metal and leave it rough, as a steel tool does. To make the most of its ability to give a smooth finish, the feed of a diamond tool should be very fine and the speeds very high.

GERMAN MACHINERY EXPORTS

One of the main features of Germany's commercial policy since the war has been to re-establish and expand her markets for machinery in eastern Europe, including Russia. These efforts have been very successful, German exports of machinery to eastern Europe having risen from a value of about $18,000,000 in 1924 to $60,000,000 in 1928. In the latter year over 20 per cent of the German machinery exports went to the eastern European market. Russia absorbs more than half and Poland about 25 per cent of the exports going to that part of Europe. Finland is also an important buyer of German machinery. The machinery exports to eastern Europe included machine tools valued at over $10,000,000, of which Russia absorbed machines to a value of about $7,500,000 and Poland about $2,000,000 worth.

* * *

The Amtorg Trading Corporation, 261 Fifth Ave., New York City, announces that during the nine months, October 1, 1928 to July 1, 1929, the Soviet Union bought about $18,000,000 worth of industrial machinery in the United States, which was 60 per cent more than the purchases for the entire preceding twelve months. Sales of Soviet products in the United States during the nine-month period mentioned reached a total of nearly $20,000,000, a gain of about $3,000,000 over the corresponding period a year ago.

MACHINERY

DESIGN — CONSTRUCTION — OPERATION

Volume 35 AUGUST, 1929 Number 12

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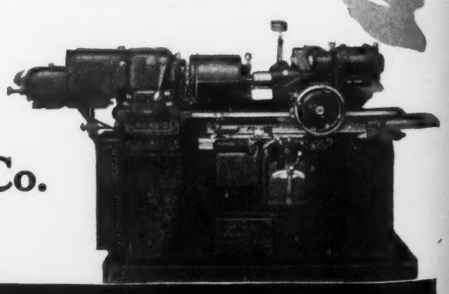
GAGE-MATIC UNIFORMITY

IT is almost uncanny the way the work drops from the Gage-Matic Internal without any perceptible difference in size or finish. Furthermore, variation in stock to be removed makes no difference in the final result, for the machine keeps grinding until the solid positive plug enters when it must be to size—no more, no less.

To officials, we say: "Run a Gage-Matic yourself for an hour, you don't have to have experience to do it, and get that thrill of hearing a perfectly dressed wheel cut like a tool, a whir and a sing that to a real mechanic's ear is only equaled by the purr of a well adjusted motor. Try the size plug, not one but any number of pieces, and see how perfect the fit, while with the no-go end, it won't even start. Turn them about and try them for taper, test them for out of roundness, hold up to the light, examine them for finish and inspect them any way you like."

For exact duplication automatically performed, the Gage-Matic has no equal. May we send you literature?

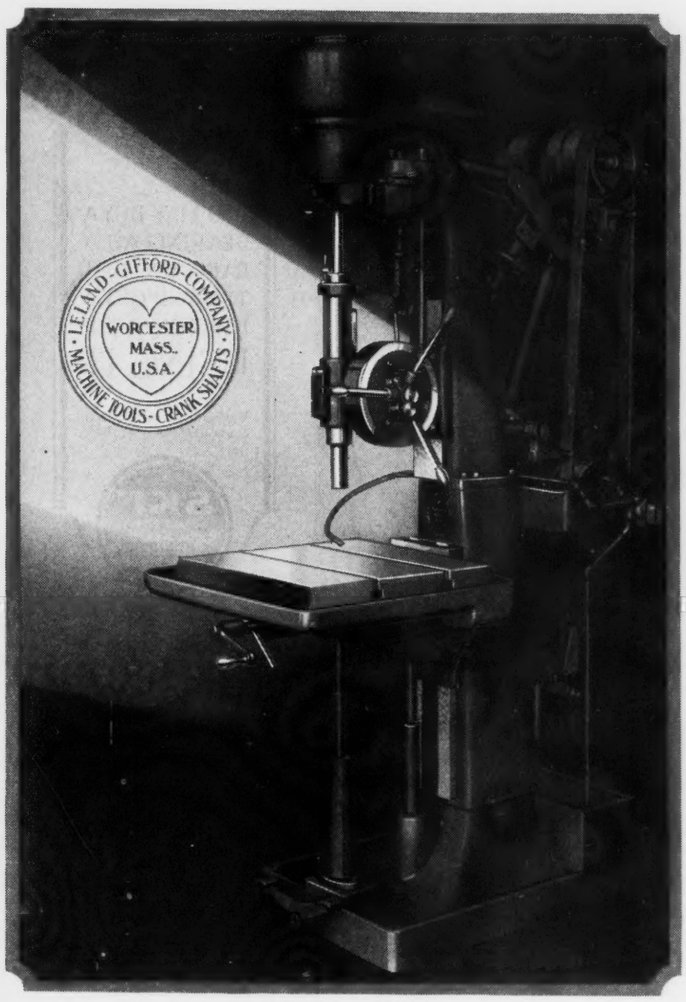


The Heald Machine Co.

Worcester, Mass.

HEALD

A Powerful, Snappy Machine



No. 3 Belted Spindle Drilling Machine. Powerful. Flexible. Three open belt speeds by direct belting to spindles. Maximum power through efficient mechanical belt tightener. Three lower speeds of greater power through ball bearing back gear unit.

Mechanical belt shifter. Semi-automatic power feed. Ball bearing back gear unit. Geared pump for wet drilling. Universal motor bracket.

Leland-Gifford Company, **Worcester, Mass., U. S. A.**

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ANOTHER ONE OF THE 143 MACHINE TOOL MANUFACTURERS
THAT USES **SKF** BEARINGS

WILLIAM SELLERS & CO., Inc.

YOU MAY BUY A BEARING AS A BARGAIN BUT TRY AND GET A BARGAIN OUT OF USING IT

for

Nothing is apt to cost so much as a bearing that cost so little.

SKF Puts the Right Bearing in the Right Place

Giants or Pigmies—Machine Tool Performance is Made Dependable with **SKF** Bearings

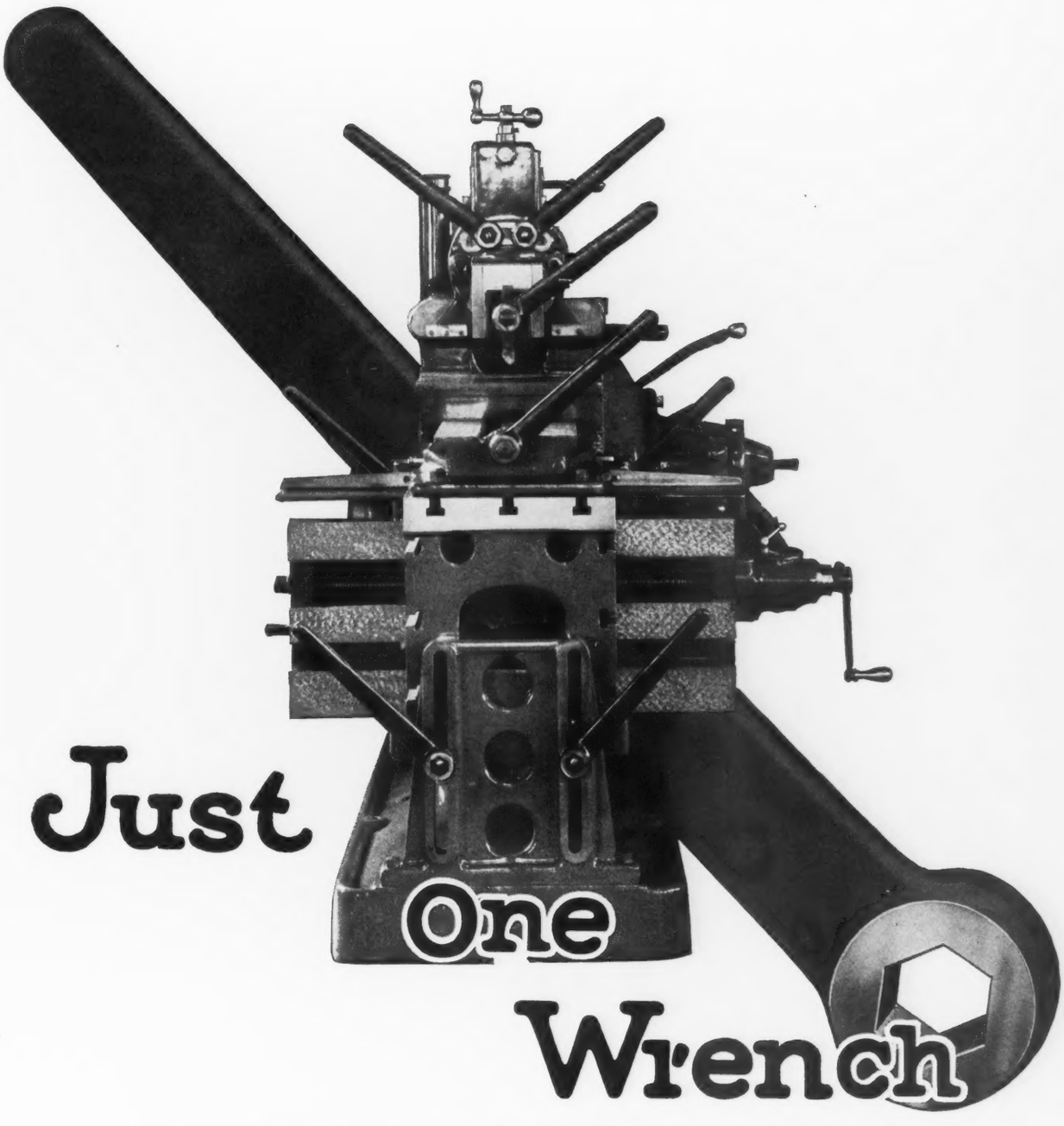
THE 24 men posed in this picture give a vivid impression of the huge William Sellers & Co. boring mill. When machinery of this gigantic size starts going . . . everything must be right! You simply can't afford to take chances by putting in something "just as good" or to save a little on parts in the building of it. And that is why **SKF**, "the highest priced bearings in the world" are used.

SKF Ball Bearings take the thrust on screws and rods for operating the saddles and slides. They also take the load on the cross rail lifting screw and are used on the pinion shaft coupled to the motor. Not only do **SKF** Bearings do their share to keep this mammoth machine going at its highest efficiency with little attention but also maintain precision of work for *they never require any adjustments*. And no matter how big or small the machine may be on which **SKF** Bearings are used they prove to be the lowest in cost per bearing hour.

SKF INDUSTRIES, INC., 40 East 34th Street, New York, N.Y. 2323

SKF

Ball and Roller Bearings



Just One Wrench

required to make adjustments on the Cincinnati Rapid Traverse Shaper. The same wrench fits them all — tool post, vise, table support, rail clamp and clapper box.

This — like the easy speed and feed changes, the new spring throwout hand feed, the automatic clamp for stroke changes, and power rapid traverse to the table—is just another one of the refinements on the Cincinnati that lessen the set up time.

You should study the many shaper refinements, exclusive to Cincinnati Shaper, described in detail in our catalog. Write for it.

THE CINCINNATI SHAPER CO., CINCINNATI, O.

Cincinnati Shapers
Rapid Traverse

You Can See Why ~

a large Eastern Manufacturer selected

TIME SAVER LATHES

The operator, from normal working position, without interference from apron, can check work and manipulate machine with ease.

Just a glance illustrates the advantage of Niles apron design, resulting in less fatigue on part of operator and ultimate increase in production.

Write for bulletin.

Left—The NILES way—Operator stands in natural position to caliper work.

Below—The average apron causes operator to reach for work.

The Niles Tool Works Company

Division General Machinery Corporation of Delaware

Hamilton, Ohio

Sales Agents—Pratt and Whitney Company

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HORSE HEAD ZINC

FOR THE DIE CASTING INDUSTRY

Strength · Utility

This generator housing is not a combination of castings, reinforcing members, extruded pieces, machined surfaces, and numerous bolts, nuts and screws.

This generator housing is a single zinc base die casting. Its strength . . . its design . . . its lack of applied parts . . . its general utility . . . immediately mark it as such.

This zinc base die casting is made with Horse Head—*uniform quality*—Zinc. This Horse Head Zinc assures die-casting strength . . . facilitates die-casting design . . . emphasizes the general utility of die casting.

New Jersey zinc

THE NEW JERSEY ZINC CO.

160 FRONT STREET, NEW YORK CITY

Zinc Metals and Alloys - Rolled Zinc - Zinc Pigments - Sulphuric Acid - Spiegeleisen

Bon Soir,
Messieurs et Mesdames~
Faites vos jeux!

"Good Evening, Ladies and Gentlemen—Place your bets!" The bets are placed, the wheel spins, there is a sudden tenseness as the little ball settles in its cup. And then? Yes, there is one winner but also there are many losers.

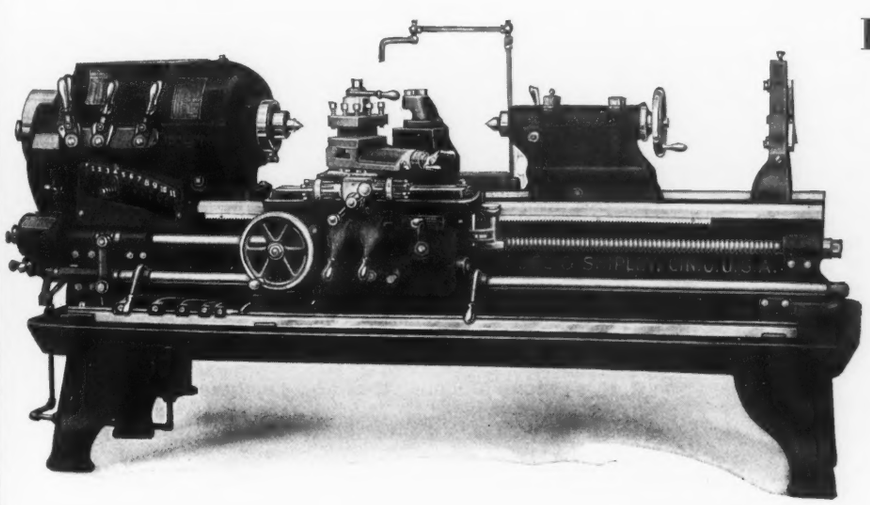
He who seeks his chances with Dame Fortune can find no better meeting place and certainly no finer gaming equipment than that afforded by Monte Carlo.

But there are many gamblers far from the wealthy little principality on the Mediterranean, who take just as great chances. And just as surely there is but one doubtful winner for many positive losers. We refer to those who take unnecessary chances in buying machine equipment. *Unnecessary* because it is so infinitely simple to buy guaranteed results.

The experience of users proves the value, the quality, the dependability of Lodge & Shipley Lathes and gives a clear picture of the results to be expected. Lodge & Shipley owners are investors, *not* gamblers. Let us tell you why.

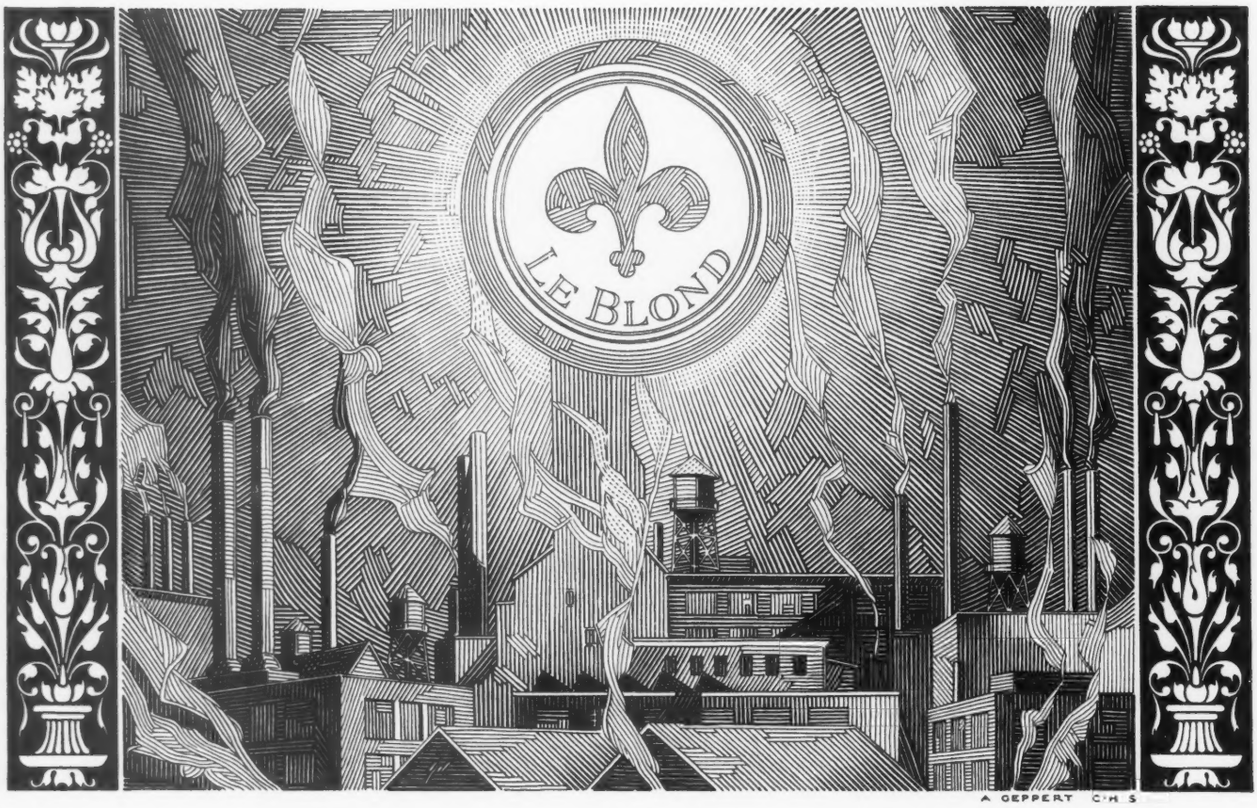
The Lodge & Shipley Machine Tool Co.

Cincinnati, Ohio



Lodge & Shipley Manufacturing Lathe

For production where quantity lots of work exceed the capacity of an engine lathe but do not warrant the use of an automatic. Ordinary lathe tools are used and, due to extreme flexibility of tooling, any number of varying lots of pieces can be machined, without additional equipment to that supplied with the machine, at a saving of 25% to 75% of engine lathe time. The attachments that make possible these time-savings in no way affect the machine's efficiency on single-piece work.



PROGRESS

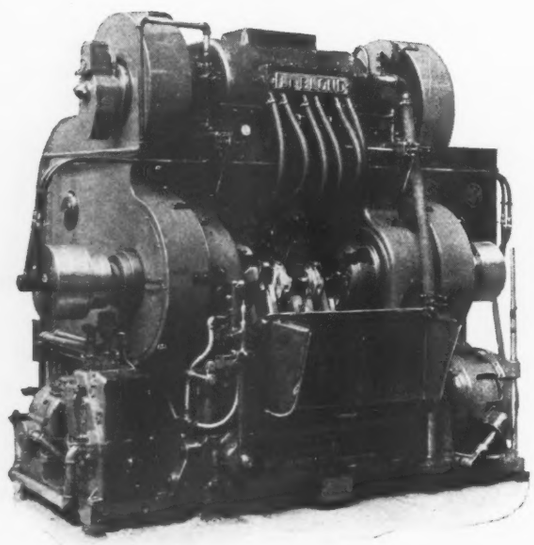
Always there must be dreamers and people who plan. Nothing is accomplished where there is no exercise of imagination. But when the dream has been visualized; the design has been developed and the experiments completed----what?

LeBlond machine tools have forty years constructive development and experience projected into every design. Every machine is a development of all its predecessors. This has made it possible and continues to make it increasingly practical to develop designs where a single machine replaces a battery.

The *progress* of LeBlond machine tools is reflected throughout the industry in increased production, the basic economic factor of American manufacturing success.

Obsolete Tools Mean Profit Starvation;

Get the Facts on LeBlond Modern Equipment



5AC Automatic Crankshaft Lathe simultaneously turns all bearings to grinding size in one operation.

LEBLOND

MACHINE TOOL DIVISION

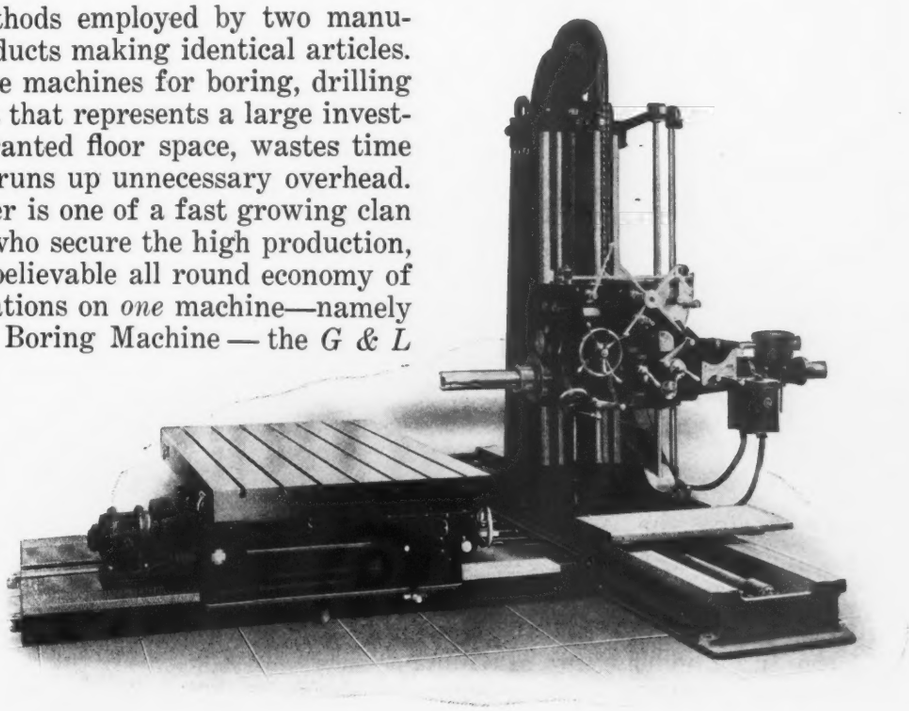
The R. K. LeBlond Machine Tool Co., Cincinnati, Ohio

Builders of Lathes — Cutter Grinders — Milling Machines — Electrical Tools — Aircraft Engines

Ground Hogs

Two bohunks with pick and shovel dig a trench in five hours. One man with a modern motor ditch digger excavates a trench of identical dimensions in half an hour. Compare!

Then compare the methods employed by two manufacturers of metal products making identical articles. One uses three separate machines for boring, drilling and milling; equipment that represents a large investment, occupies unwarranted floor space, wastes time in handling work and runs up unnecessary overhead. The other manufacturer is one of a fast growing clan of alert industrialists who secure the high production, rigid accuracy and unbelievable all round economy of performing *three* operations on *one* machine—namely the G & L Horizontal Boring Machine — the *G & L Method.* Investigate.

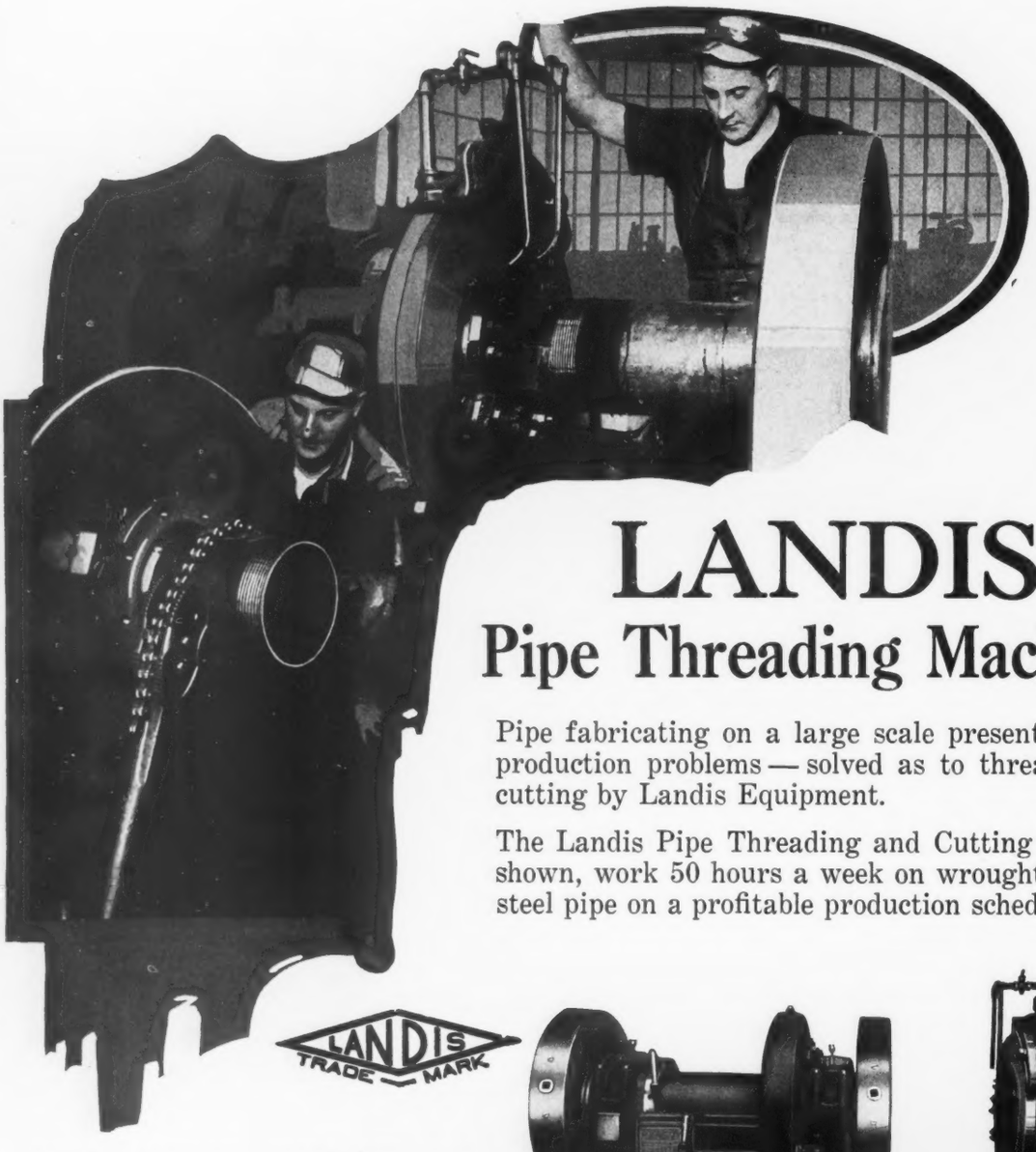


SPECIALISTS IN HORIZONTAL BORING, DRILLING AND MILLING

GIDDINGS & LEWIS MACHINE TOOL CO., Fond Du Lac, Wis.

FOUNDED 1859

LANDIS for Pipe Thr

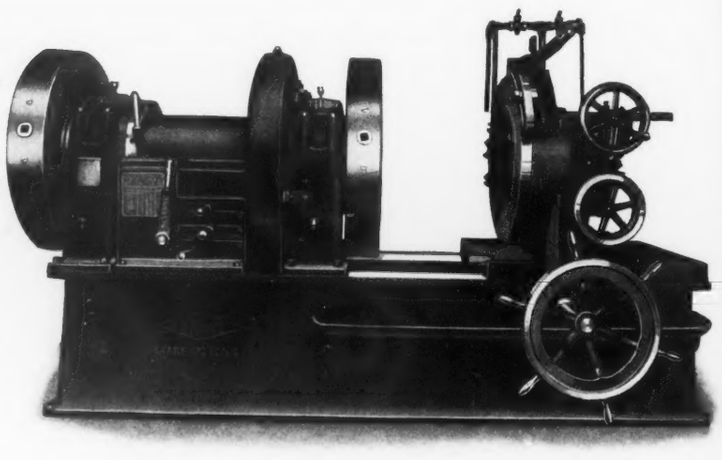


LANDIS
Pipe Threading Machines

Pipe fabricating on a large scale presents its own production problems — solved as to threading and cutting by Landis Equipment.

The Landis Pipe Threading and Cutting Machines shown, work 50 hours a week on wrought iron and steel pipe on a profitable production schedule.

LANDIS TRADE MARK



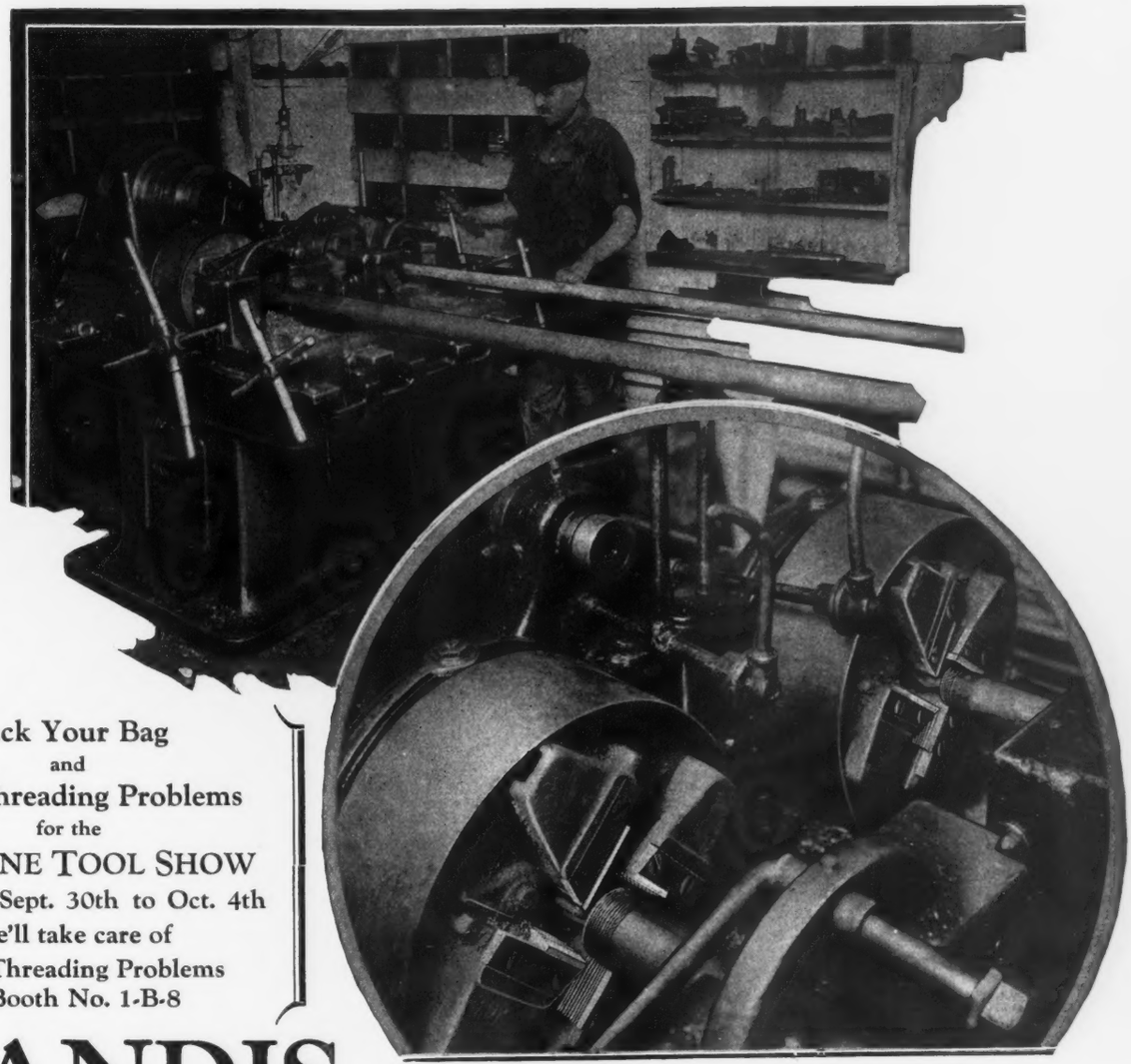
Landis accuracy, speed, low operating costs, the wide working range of each machine and the diversity of sizes — from 2 to 20 inches — in which Landis Pipe Threading and Cutting Machines are made—provides efficient equipment for all kinds of pipe work.

LANDIS MACHINE COMPANY, Inc.

Cleveland Office:

DOMESTIC AGENTS: Young & Vann Supply Co., Birmingham, Ala.; Herberts Machinery & Supply Co., Los Angeles, Calif.; Herberts Moore Machinery Co., San Francisco, Calif.; Hendrie & Bolthoff Mfg. & Supply Co., Denver, Colo.; R. S. Armstrong & Brother Company, Atlanta, Ga.; Marshall & Huschart Machinery Co., Chicago, Ill.; Marshall & Huschart Machinery Co. of Indiana, Indianapolis, Ind.; Woodward Wight & Co., New Orleans, La.; Shreveport, La.; Tampa, Fla.; R. B. Whitacre & Co., St. Paul, Minn.; Colcord Wright Machinery & Supply Co., St. Louis, Mo.;

hreading Production



Pack Your Bag
and
Your Threading Problems
for the
MACHINE TOOL SHOW
Cleveland, Sept. 30th to Oct. 4th
We'll take care of
Your Threading Problems
at Booth No. 1-B-8

LANDIS
Pipe and Nipple Threading Machines

Production machines, cutting accurate threads economically; typical Landis equipment for profitable manufacturing service in a specialized field.

Work-holding vises are quick and convenient in operation, with horizontal sidewise, as well as vertical centering, adjustment to insure the *accurate alignment with the die,* so important in threading operations.

Landis Pipe and Nipple Threading Machines are made in sizes up to 4", in single and multiple heads, with belt or motor drive.

Landis Production Threading Equipment includes machines to handle all kinds of pipe and bar work, fitted with *correct die heads* using the well known Landis Chaser for each class of work.

If you thread pipe, bar stock—or anything else—ask Landis Threading Engineers to recommend equipment that will guarantee profits.

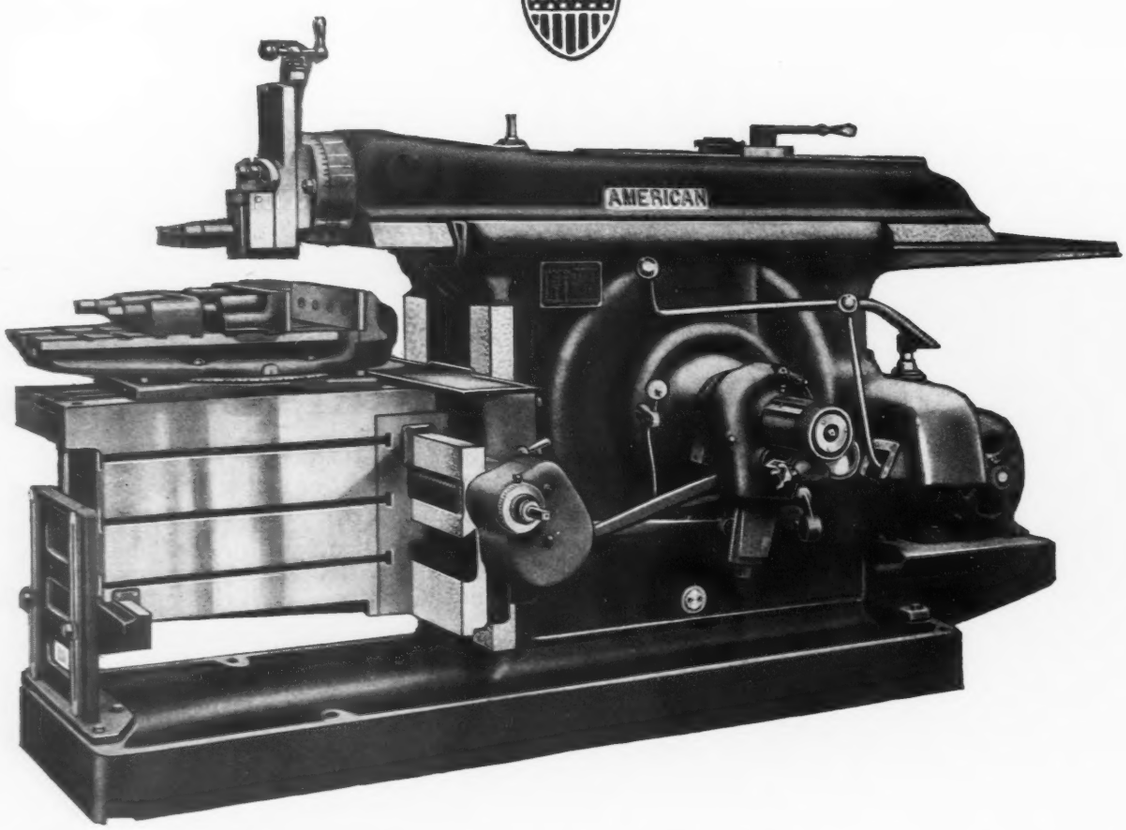
Waynesboro, Pa., Detroit Office, 5928 Second Blvd.
504-505 Marshall Bldg.

Harry M. Euler Co., Portland, Ore.; D. S. Mair Machinery Co., Houston, Texas; Salt Lake Hardware Co., Salt Lake City, Utah; Hallidie Machinery Co., Seattle, Wash.; Hamilton Machinery Co., Chattanooga, Tenn.
CANADIAN AGENTS: Canadian Fairbanks Morse Company, Montreal, Toronto; Winnipeg; Vancouver.

"AMERICAN"
Auto-Oiled
SHAPER

Is Producti

"AMERICAN"



THE AMERICAN TOOL WORKS C

...ion a Race?

Under present conditions the capacity for immediate deliveries of manufactured articles determines in large measure who will sell the goods. Thus we have a race—healthy competition between manufacturers who are in a position to turn out high quality products quickly.

And here is where the American Auto-Oiled Shaper adds the impetus of its production ability to organized industry. Every detail of this machine is designed to withstand indefinitely the demands of constant use. From its efficient automatic oiling system to its outward appearance it bespeaks its ability to perform the most difficult task. In every variety of service this machine has proved its inherent competence to perform all classes of work at the highest practicable speeds and coarsest feeds, and to produce at the same time a finished product of unquestioned, uniform accuracy.

LATHES
RADIALS
SHAPERS

...KS COMPANY, Cincinnati, U. S. A.

Assembling of Threa d

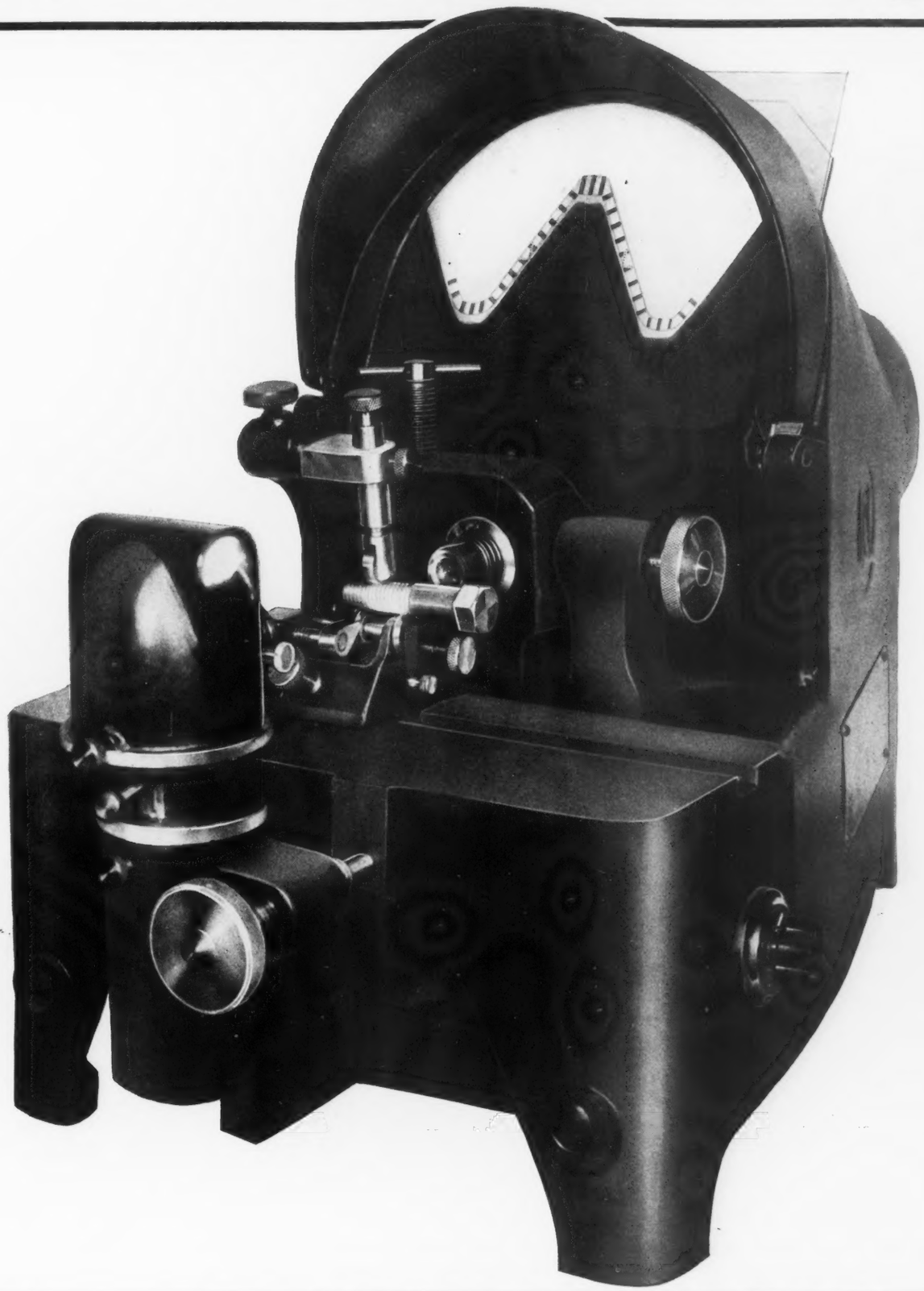
Not by making the Screw small enough and the Tapped Hole large enough

But by making Screws that fit the Threaded Holes

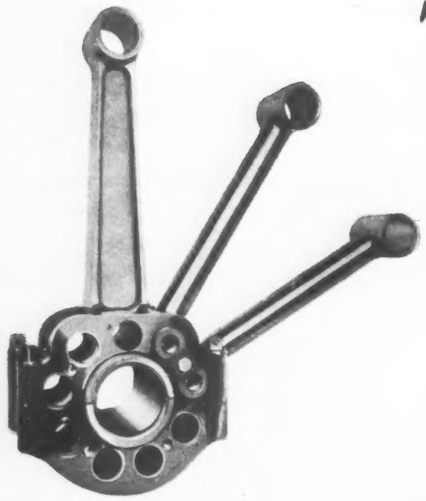
The Hartness Screw Thread Comparator Guarantees Screws That Fit

JONES & LAMSON MACHINE.COM P

ded Parts Made Easy

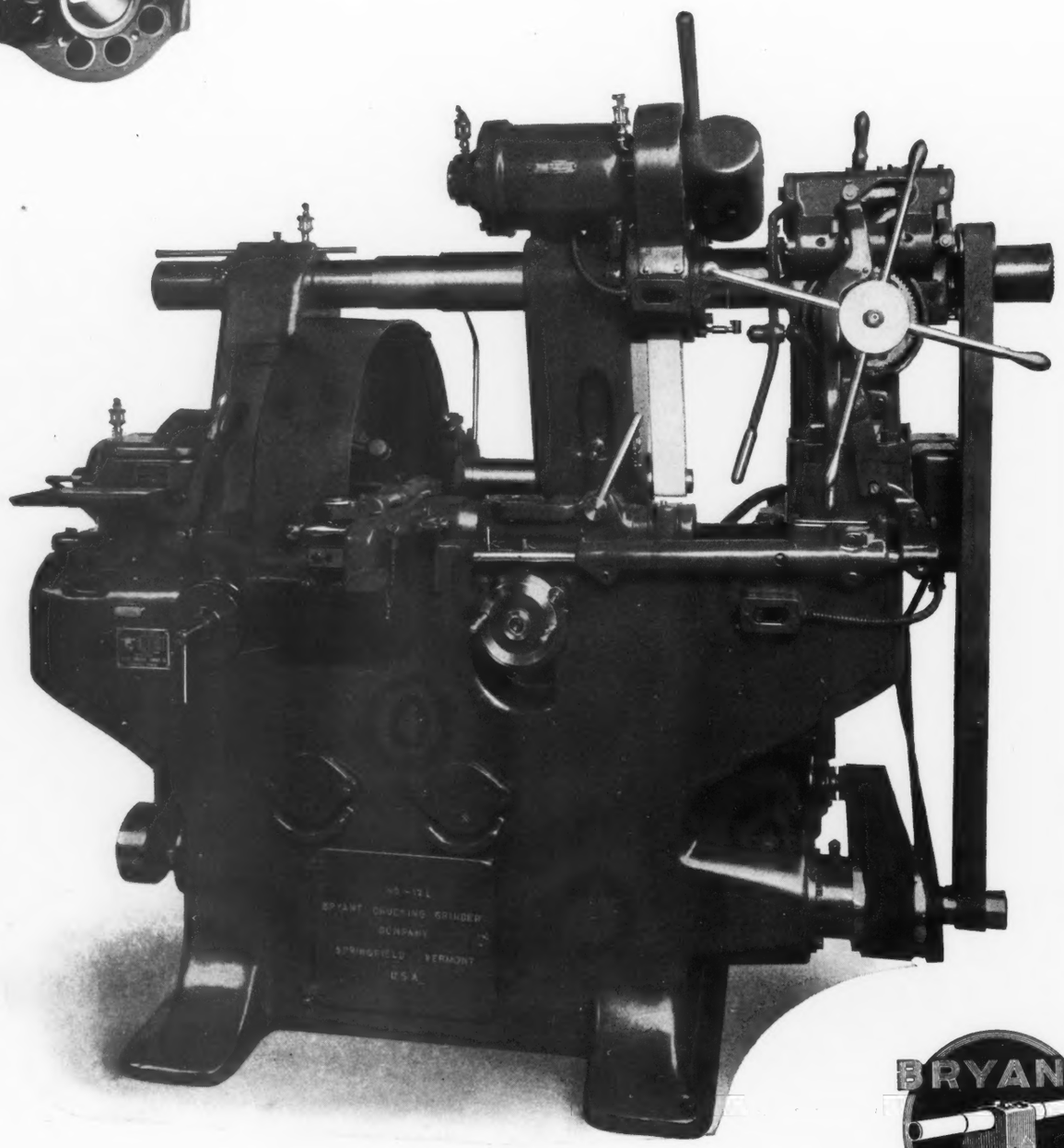


PANY, SPRINGFIELD, VERMONT



There is a Reason

why the large manufacturers of aircraft motors use Bryant No. 12-L large swing grinders for grinding holes in connecting rods. Ask for information.

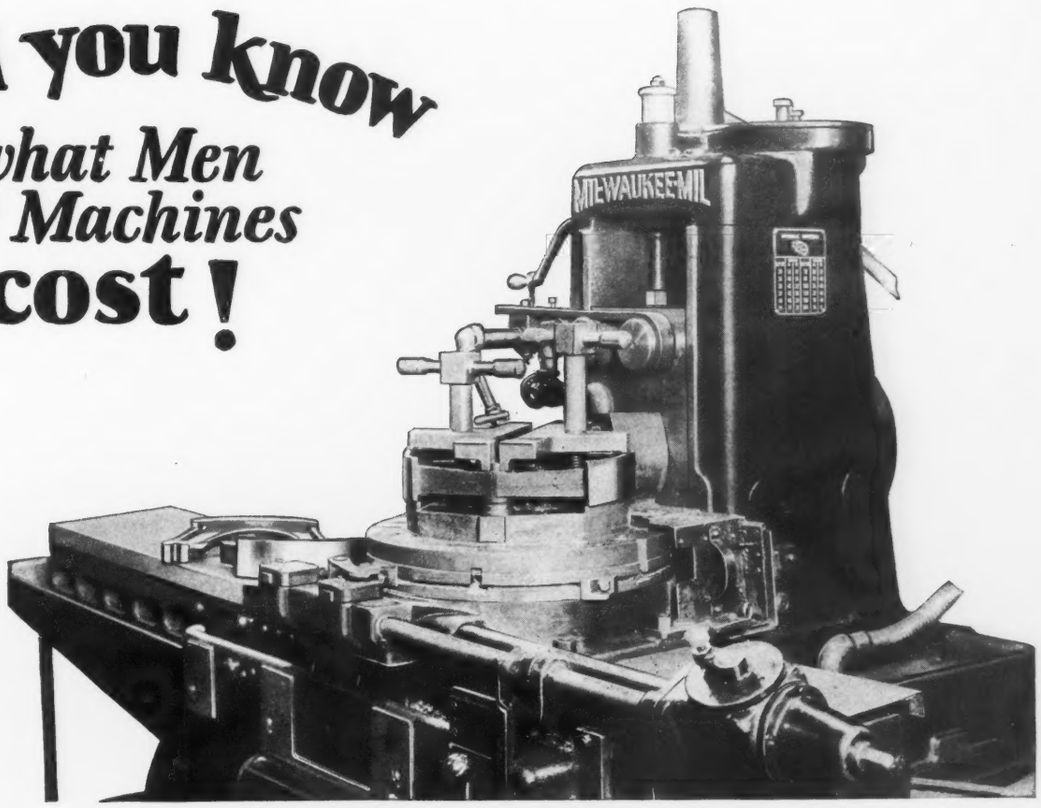


BRYANT CHUCKING GRINDER CO.

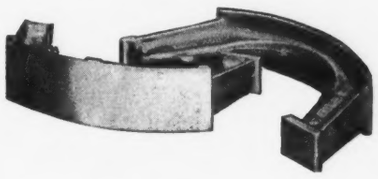
350 Clinton Street, Springfield, Vermont

U. S. A.

-and you know *what Men and Machines* cost!



THIS Mil-waukee-Mil released three operators for other work, replaced several other machines in the line with a resultant saving in floor space, and actually increased production over 100%. Quite a record for one machine and a single operator!



It is such savings as this that have brought the Mil-waukee-Mil to the foreground and made it the leading production milling machine of the day.

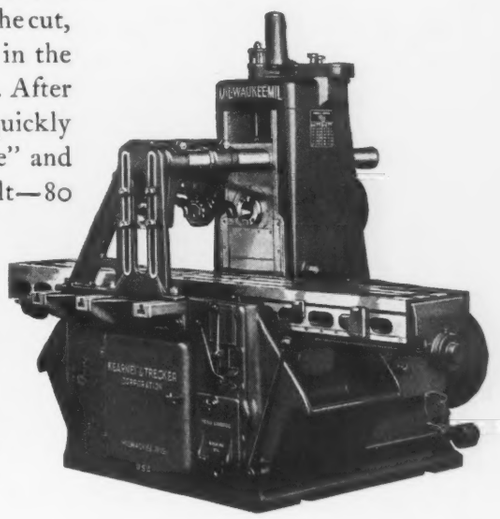
The problem was to circular-mill automobile brake shoes—malleable castings 2½" wide and 11½" around the periphery.

The solution—a 1403 Mil-waukee-Mil Simplex with a simple hand clamping fixture and a skip-stop rotary table to automatically control the milling cycle. This eliminates all idle machine and operator time.

Two double-link brake shoes are mounted in the fixture at one time. While one shoe is in the cut, the workpiece is changed in the opposite side of the fixture. After finishing the cut the table quickly rotates past the "air space" and the next cut begins. Result—80 pieces per hour, continuously — day after day. Have you ever noticed how K & T Production Service jobs avoid idle time?

No milling machine of the past decade has offered so many new and basic developments as the new Mil-waukee-Mil. It stands out sharply as an example of machine design in which the benefits and economies of unit construction are awarded to the user.

KEARNEY & TRECKER CORPORATION
MILWAUKEE, WIS., U. S. A.



A list of Mil-waukee-Mil users reads like "Who's Who in Industry."

high production! on castings of varied shapes

IN many shops that have short runs of different pieces, or where long runs must occasionally be broken into with a few castings of another type, this Ingersoll rotary will introduce the savings obtainable through continuous milling without the necessity for expensive tooling for each part.

The machine illustrated mills die sets or subpresses. They are similar in general design, in that each has a flat base to be machined, but come in all shapes and sizes from 6 inches to 30 inches long.

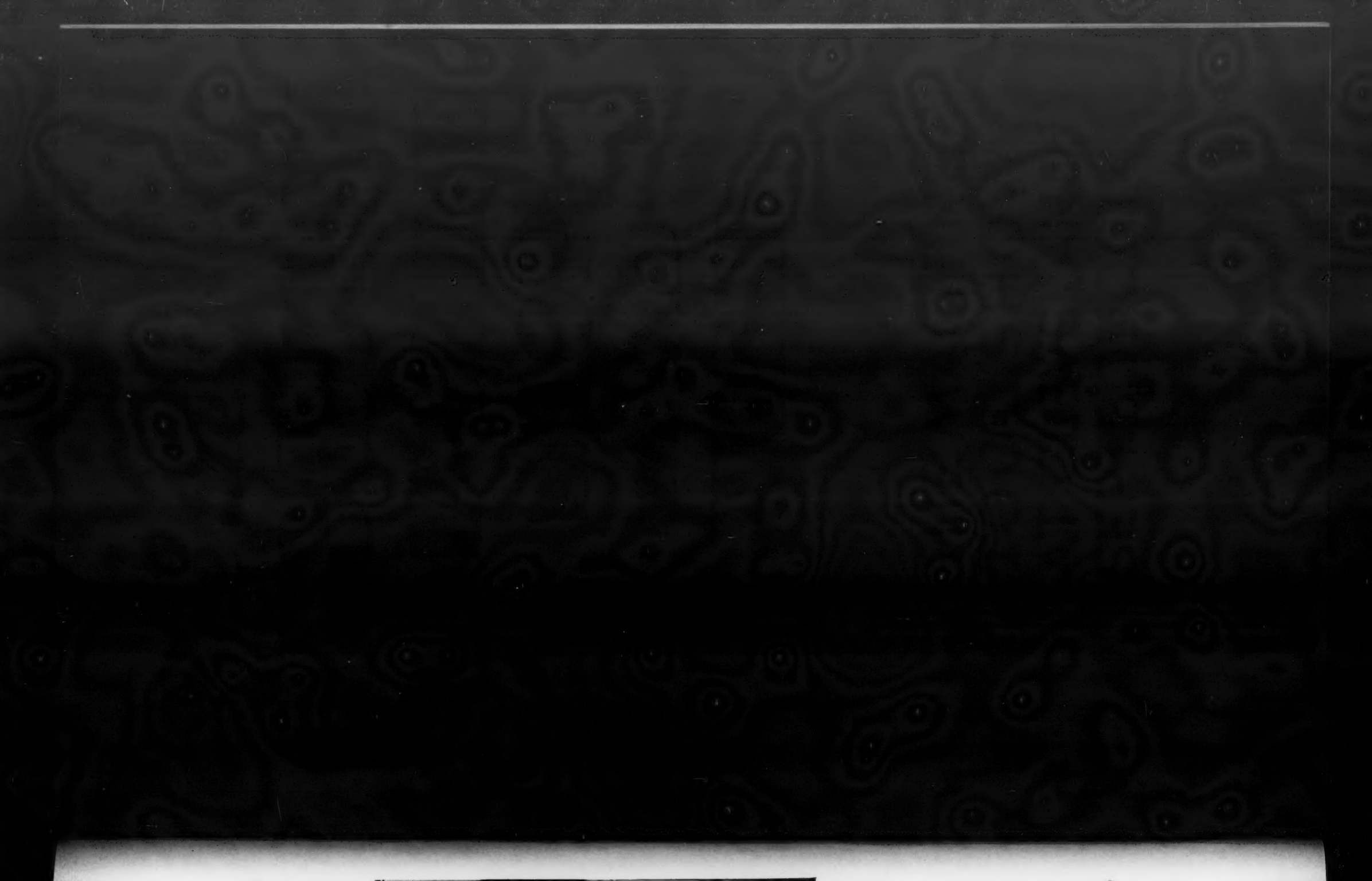
The adjustable fixtures are so arranged that different pieces may be clamped in them without stopping the table feed. In this way the equipment may be used on a long run of duplicate parts, or it may handle shorter runs or even single pieces if required. The close-up of the table shows a number of different castings in the fixtures.

This is a good example of a special Ingersoll machine. Ingersolls are built for milling, boring, and drilling. Most of them are, like this one, furnished complete with fixtures and cutters, placing the whole responsibility for successful operation upon us. Write for bulletins describing and illustrating our equipment.

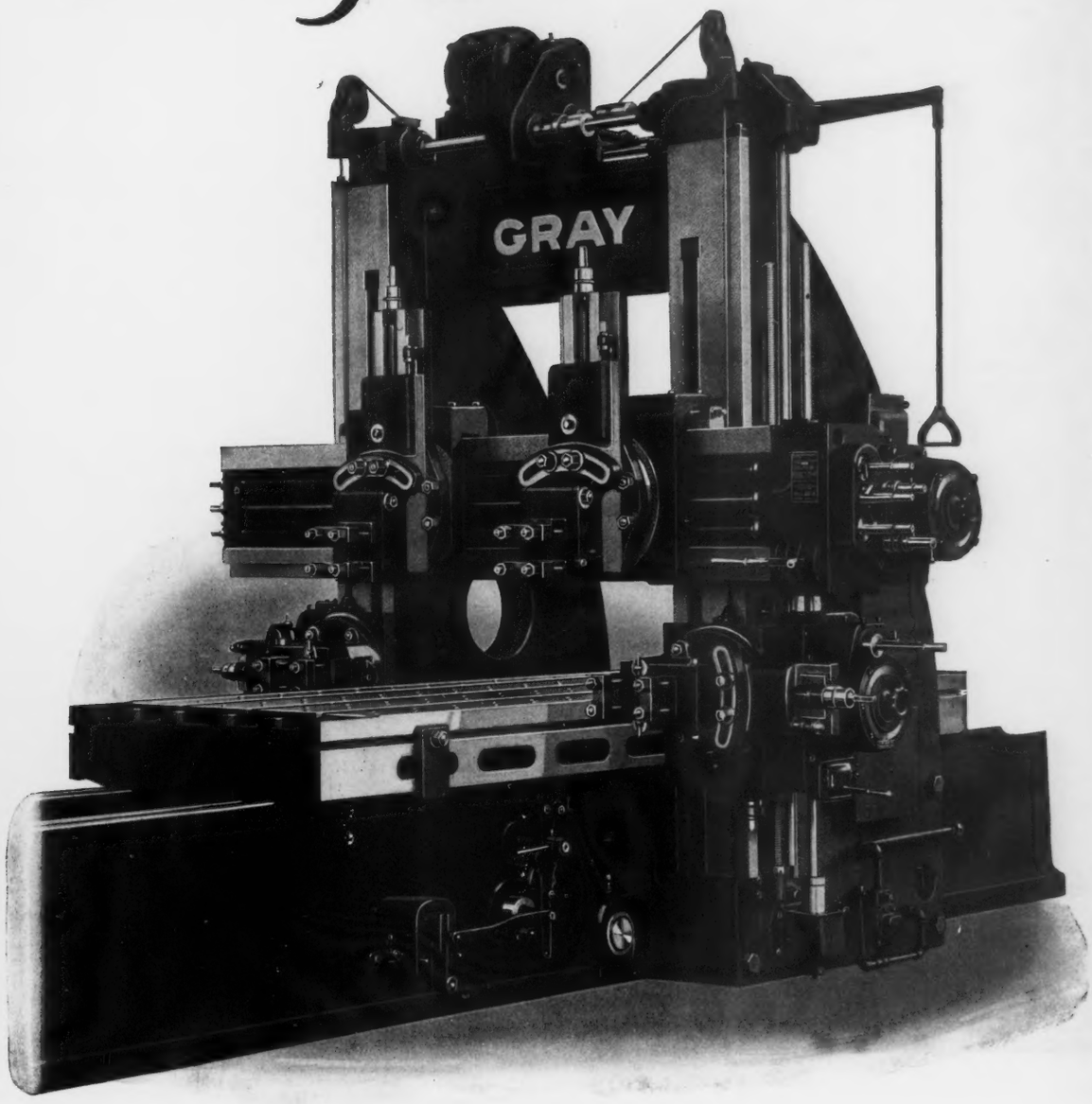
The Ingersoll Milling Machine Co.

MILLING MACHINES AND SPECIAL MACHINE TOOLS

Rockford, Illinois, U.S.A.



Gray Planers



With a Gray Planer and some "know-how" scraping may be practically eliminated.

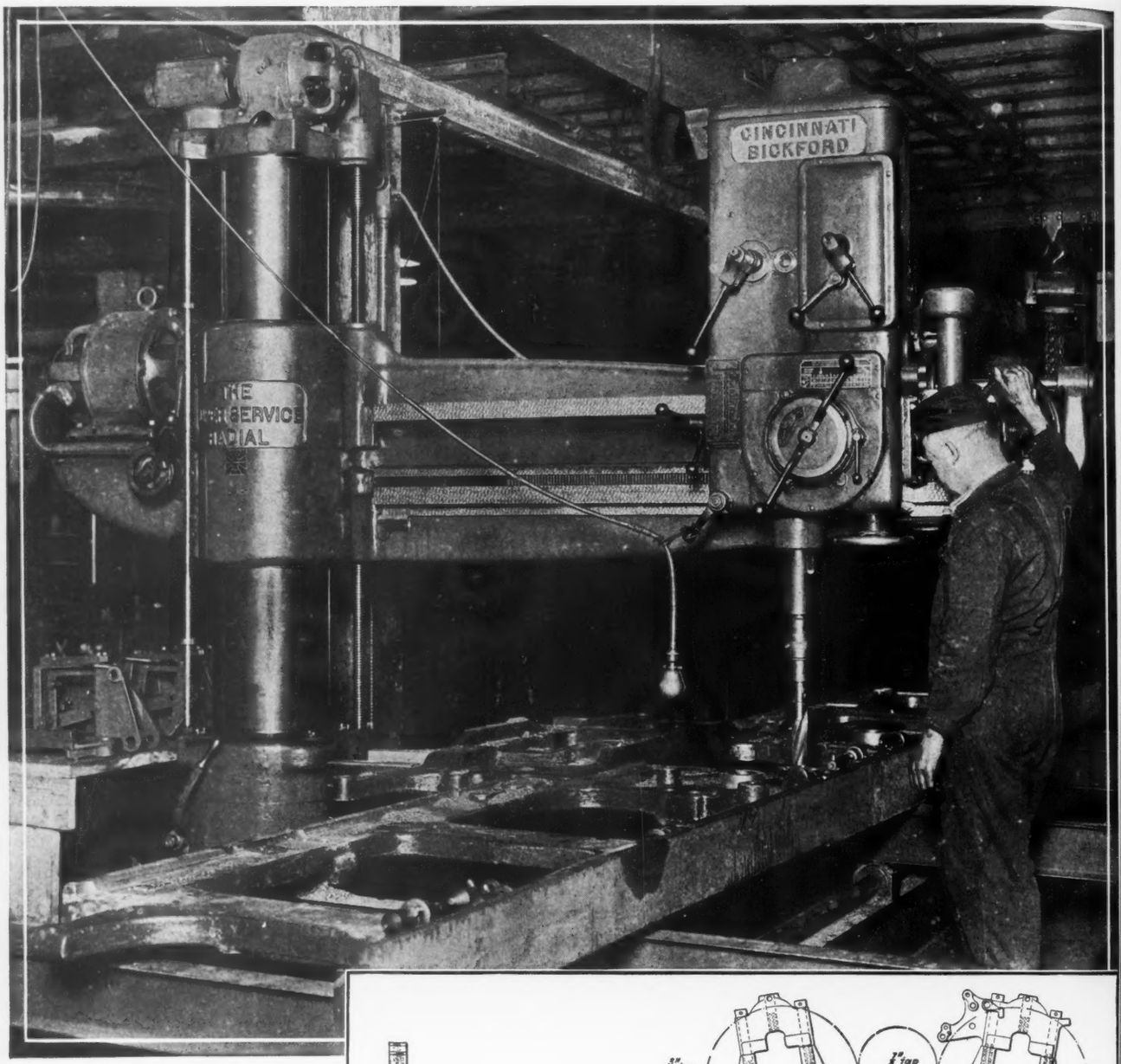
If a job is not turned true you can improve it by grinding; if it is not bored true you can improve it by reaming; but if it is not planed true you can improve it only by hand scraping, which is slow and expensive.

An accurate finishing cut with a broad-nosed planer tool can be taken in a fraction of the time required, even by a skilled fitter, to remove the metal with a scraper.

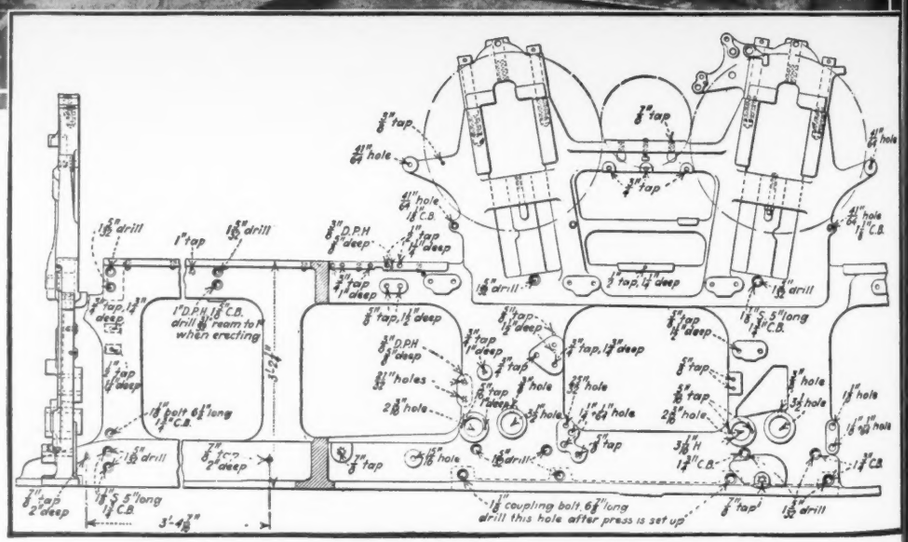
That good planer work obviates the need of scraping is proved by the fact that we do not have to scrape the V's of our beds and tables to produce a bearing. The only scraping we do on them is to remove the loose iron and to harden the surface.

THE G. A. GRAY CO., Cincinnati, Ohio

Openside and Double-Housing Maximum Service Planers



The SUPER - SERVICE RADIAL drills this side frame for a large printing press in 9 man-hours. Formerly two machines and 14 man-hours were required.

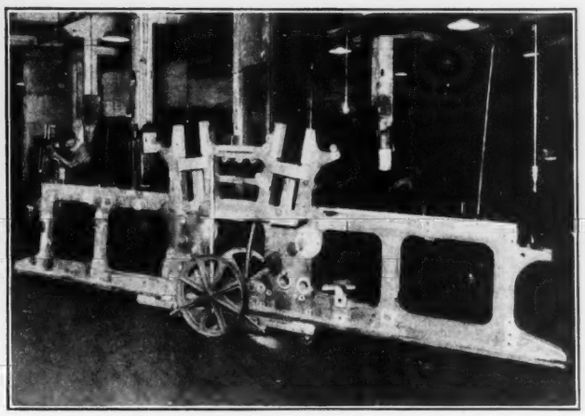

1" tap
41/64" hole
1" tap
41/64" hole
1 1/8" C.B.
1 1/8" drill
1" tap
1 1/8" drill
3/8" D.P.H.
1" deep
1" tap
1" deep
1 1/8" drill
1" tap, 1 1/4" deep
1 1/8" drill
1 1/8" S. 5" long
1 1/8" C.B.
1" tap, 1 1/4" deep
1" D.P.H. 1 1/8" C.B. drill 61/64" ream to 1" when erecting
3'-2 1/4"
1" tap, 1 1/4" deep
3/8" D.P.H.
1" deep
1" tap
1" deep
1" tap, 1 3/4" deep
1" tap
1" deep
1" tap
1" deep
1" tap
1

14 HOURS CUT TO 9

With This Super-Service Radial

HERE'S an example of a saving that does not involve a change of method. The 6′ SUPER-SERVICE Radial, shown opposite, replaces two 6′ radials and cuts the time from 14 to 9 man-hours.

The work is the drilling, boring, tapping and reaming of the side frame for a large printing press. Formerly two radials, about 12 years old, placed side by side, worked on opposite ends of the frame. Each had its own operator.



Now one SUPER-SERVICE Radial and one operator takes care of the whole job, and saves more than 35% of the previous time.

A helper is required only when a heavy jig must be placed or removed. *A total of nine man-hours completes the same work that formerly required fourteen man-hours and two machines.* This saving in drilling time is due largely to the centralized control and easy operation of the SUPER-SERVICE Radial. This work requires frequent changes of speed and feed, and frequent changes of spindle location.

Manipulating Time Reduced

The correct speed and feed for each size drill or reamer is instantly obtained. The controls for 36 speeds and 18 feeds are within easy reach of the operating position. There is no need for the operator to walk from one end of the machine to the other to change spindle speeds.

He unclamps and clamps the column, for each change in spindle location, without moving from the operating position. The column is clamped by power controlled by a button on the head. Manipulating time is reduced to the minimum. Power rapid traverse enables the operator to spot the drill quickly and without effort.

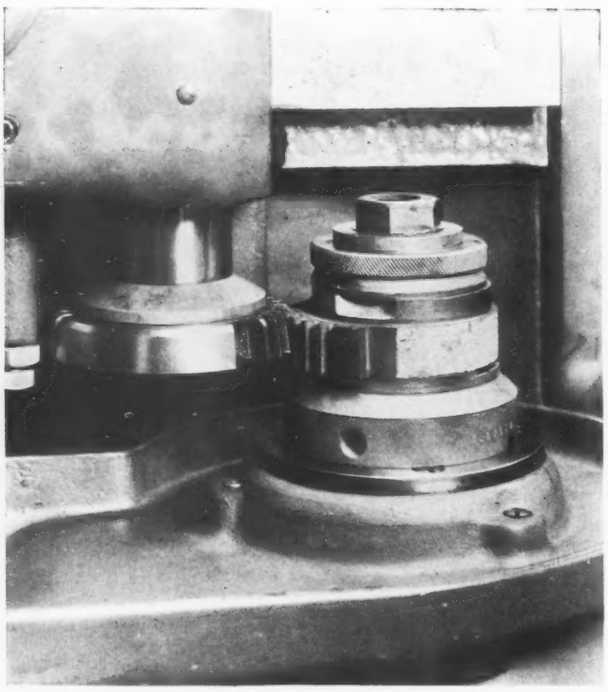
Other features of the SUPER-SERVICE Radial include the Easy Swinging Arm, Single Lever Arm Control, Compensating Dial Depth Gauge and construction features that make for greater rigidity, long-lived accuracy and high production.

These features have made remarkable savings for others. It will pay you to replace a remote controlled radial with a SUPER-SERVICE.

COMPANY, OAKLEY, CINCINNATI, OHIO.

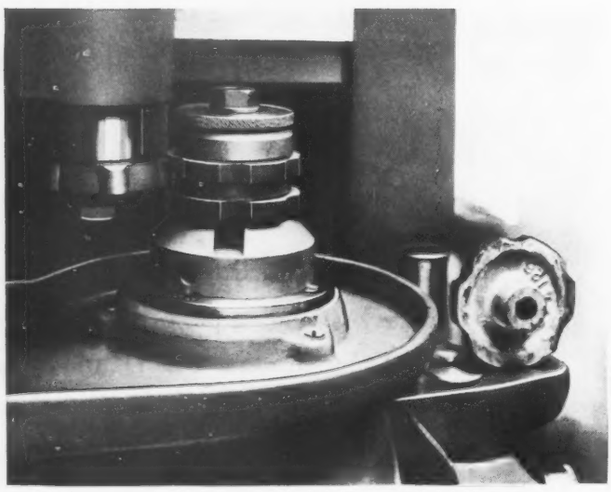
How The Textile

Profits by Using the



The textile manufacturer profits in two ways by using the High-speed Gear Shaper. First he gets high production and low costs, and second he has available a standard machine which, by the application of suitable fixtures, can be adapted to a large range of work.

Take the gear on the bottom shaft of an automatic cotton loom as an example. Here with one cutter and in one operation it is possible to cut the gear teeth and thicker projection at the same setting.



The chain cylinder check wheel for an automatic cotton loom is another good illustration of the adaptability of the High-speed Gear Shaper and Gear Shaper Cutter. This member is to be machined on the external circumference, and six semi-circular grooves cut. All done at the same setting and with the same cutter.

THE FELLOWS GEAR SHAPER

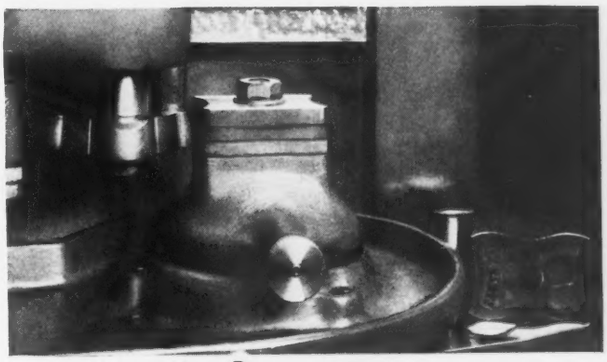
Head Office and Works:

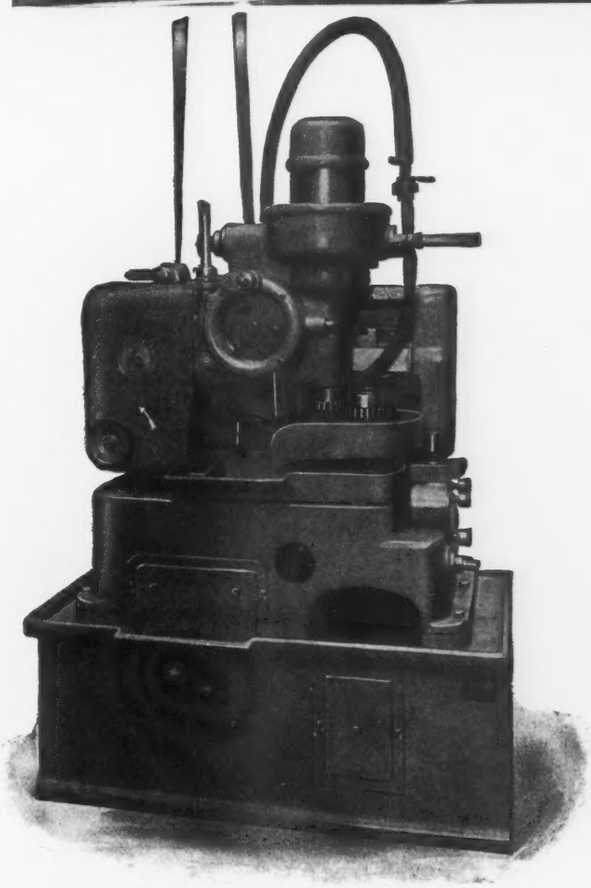
Branch Office: 1149 Book

FOREIGN AGENTS: Alfred Herbert, Ltd., Coventry, England, Great Britain; Alfred Herbert, Ltd., Calcutta and Bombay, India; Alfred Herbert, Ltd., Osaka, Japan and China; Alfred Herbert (Australasia), Ltd., Sydney, Australia; Societe Anonyme Alfred Herbert, Paris, France; Societa Anonima Italiana Alfred Herbert, Milan, Italy; Societe Anonyme Belge Alfred Herbert, Brussels, Belgium and Holland; Bohm & Bormann, Berlin, Germany, Austria, Czecho-Slovakia, Poland & Hungary; Aktiebolaget A. Bonthron, Stockholm, Sweden, Finland and Norway; Mathey-Doret & Forrer, Zurich, Switzerland; Hijo de Miguel Mateu, Barcelona, Spain.

Manufacturer

High-speed Gear Shaper





A rather unusual job is shown in the illustration to the right. This is a check plate for an automatic cotton loom. The semi-circular ends are machined to a definite radius and must be held in relation to the dowel pin holes. Two pieces, as illustrated, are held at one time on an indexing fixture. The cutter used has four lobes, and in addition to generating the semi-circular ends on the work, the corners are also rounded. The fixture is indexed by hand at the completion of each cut—two indexes completing the work held at each setting.

The High-speed Gear Shaper presents many possibilities for increased profit to those manufacturers who produce interchangeable parts. We may be able to help you cut your costs; at least you will in no way obligate yourself by asking for a copy of catalogue No. 10.

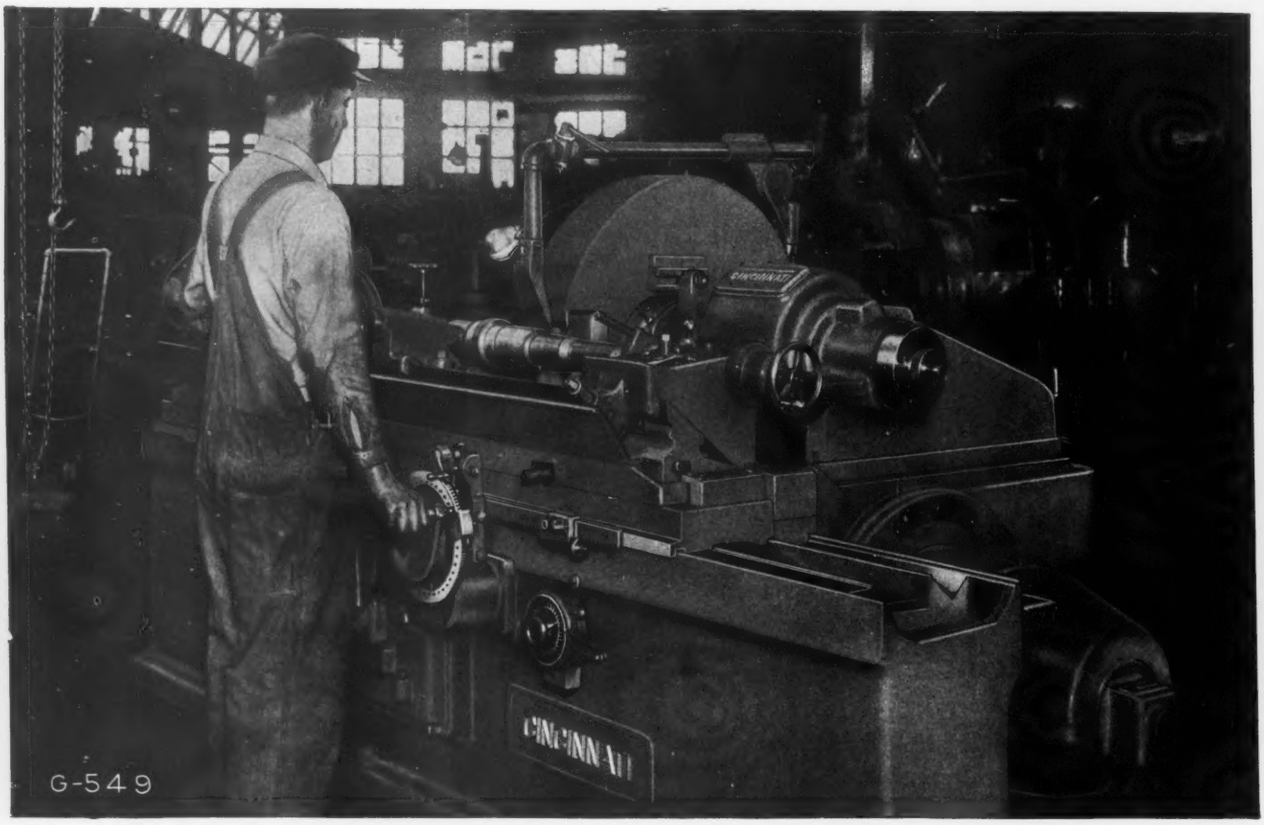
COMPANY, Springfield, Vermont

78 River Street

Building, Detroit, Mich.

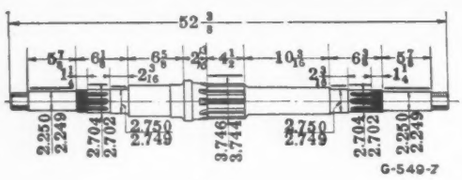
SOUTHERN REPRESENTATIVES: R. S. Armstrong Brothers Company, Atlanta, Georgia; Montgomery & Crawford, Spartanburg, S. C., South Carolina & Western North Carolina; Young & Vann Supply Company, Birmingham, Alabama; Cahn-Richards Tool & Supply Company, New Orleans, Louisiana, Mississippi, Western Florida & Eastern Texas; Huey & Philp Hardware Company, Dallas, Western Texas.
PACIFIC COAST REPRESENTATIVES: C. F. Bulotti Machinery Company, San Francisco, for Northern California; Reeves & MacBride, Los Angeles, for Southern California.

CINCINNATI GRINDERS INCORPORATED, CINCINNATI, OHIO



Patented

HEAVY DUTY SHAFT GRINDING MACHINE



Part Name—Splined Shaft.
Material—Heat-treated steel.
Operation—Grind 7 diameters.
Stock Removed—.020" to .025".
Finish—Good commercial.
Limits—See sketch.
Previous Time—55 minutes.
Present Time on this Machine—33 minutes.
Wheel—Size 30" diameter x 4" face x 20" hole.
Grit and Grade—50-P-25 Aloxite.
Maker's Name—The Carborundum Company.
Machine—14"x48" Cincinnati Plain Self-contained Grinder with standard equipment.

This machine realized for the purchaser a saving of 40% of the time originally required to perform this work.

There are many features which have made these machines exceptional producers of accurately ground work at a high rate of metal removal. The pressure feed table lubrication system insures the correct lubrication for the table ways whether the machine is used on short- or on long-stroke work. The extra heavy wheel spindle mounting insures freedom from vibration and maximum power at the point of grinding. The heat-treated sliding gears for the table traverse speed changes enable the operator to change the rate of traverse of the table with the minimum amount of effort. The centralized control enables the operator to control the machine with less fatigue.

You are probably grinding work of a similar nature with many diameters and could profitably use one of these productive grinding machines. We will be glad to analyze your problems and recommend the best machine for your particular work.

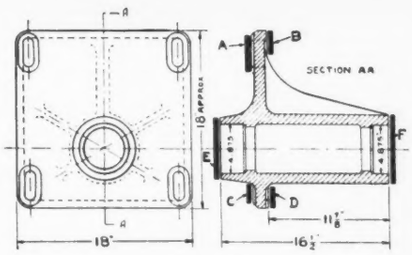
Dependable Counsel on Grinding

CINCINNATI GRINDERS

THE CINCINNATI MILLING MACHINE COMPANY, CINCINNATI, OHIO

Patented

SMALL LOTS PROFITABLE ON HYDROMATIC!



2521-Z

Name of Part—Chain Gear Bracket.
Operation—Mill bolt bosses.
Material—Cast Iron.
Stock Removed—3/16" on all surfaces.
Cutters—Quick change collets—Two —2" end mills.
Cutter R.P.M.—150.
Feed—6" per min.
Time per piece—18.5 min.
Production per hour—3.
Machine—4-48 Plain Cincinnati Hydromatic.

A leading machine tool manufacturer who is credited as having one of the finest and most modern shops, has selected a number of Cincinnati Hydromatics for his work. Small lots characterize the type of work that flows through the shop that is being run on a production basis. This is possible because the operator can run two machines, several operations are combined, and faster and heavier milling cuts can be taken because of the locked hydraulic feed, resulting in a net saving which warrants the purchase of these machines.

The above illustration shows the set up for the first operation of milling the bolt bosses of a chain gear bracket, (See sketch, surfaces A, B, C and D). The top bosses are milled by the left hand end mill and the bottom by the right hand end mill. This necessitates the use of the 90 degree hand indexing fixture that is mounted on the machine table. The bracket is located on a rough cast surface and is clamped into position over fixed supports by U washers and a long bolt extending through the cored shaft hole. Two face mills with quick change collets for the 2" end mills are used enabling the operator to remove the end mills at the completion of the first operation, and therefore having the face mills all set for the second operation of milling to length the bearing edges E and F. An exclusive feature—automatic dog control of the table working cycle found on all Cincinnati Hydromatics was used to a good advantage giving rapid advance to the first boss, feed, rapid advance to the next boss, feed and rapid return to the operator—no lost time and no attention required on the part of the operator.

Investigate the possibilities for your work—get the performance facts!

"Dependable Counsel on Milling"

CINCINNATI MILLERS

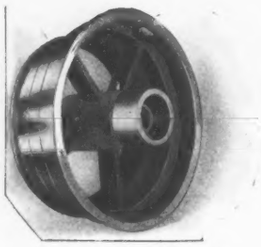
THE JOHNSON FRICTION CLUTCH

As Used In

MACHINE SHOPS & FACTORIES

On

LINE SHAFTING LINE SHAFTING



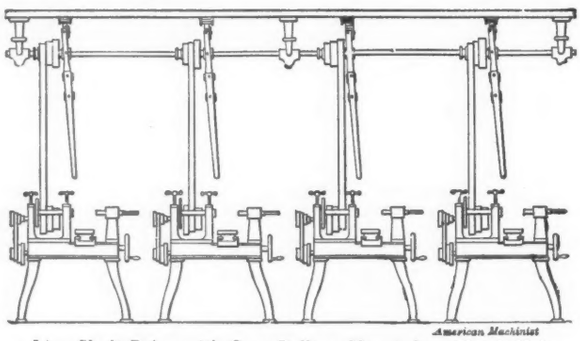
Three Step Cone Pulley mounted on Clutch Hub.

Single Clutch with Pulley Mounted

Single Clutch Exterior

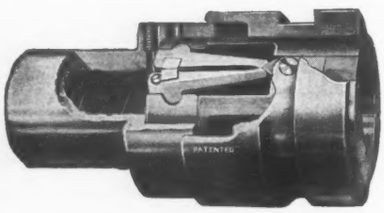
Here's the well-known JOHNSON Clutch, used nation-wide in all industries. Full range of sizes and designs. Get our full data. Equip with JOHNSONS.

Daily use for years on thousands of machines and lineshafts throughout the country has proved the JOHNSON Friction Clutch to be the ideal clutch for Machine Shops and Factories. The JOHNSON insures smooth starting, instantaneous stopping, and perfect control at all times.



Line Shaft Drive with Cone Pulleys Mounted on Clutch Hubs

YOU GET 15 to 20 YEARS' SERVICE from a JOHNSON



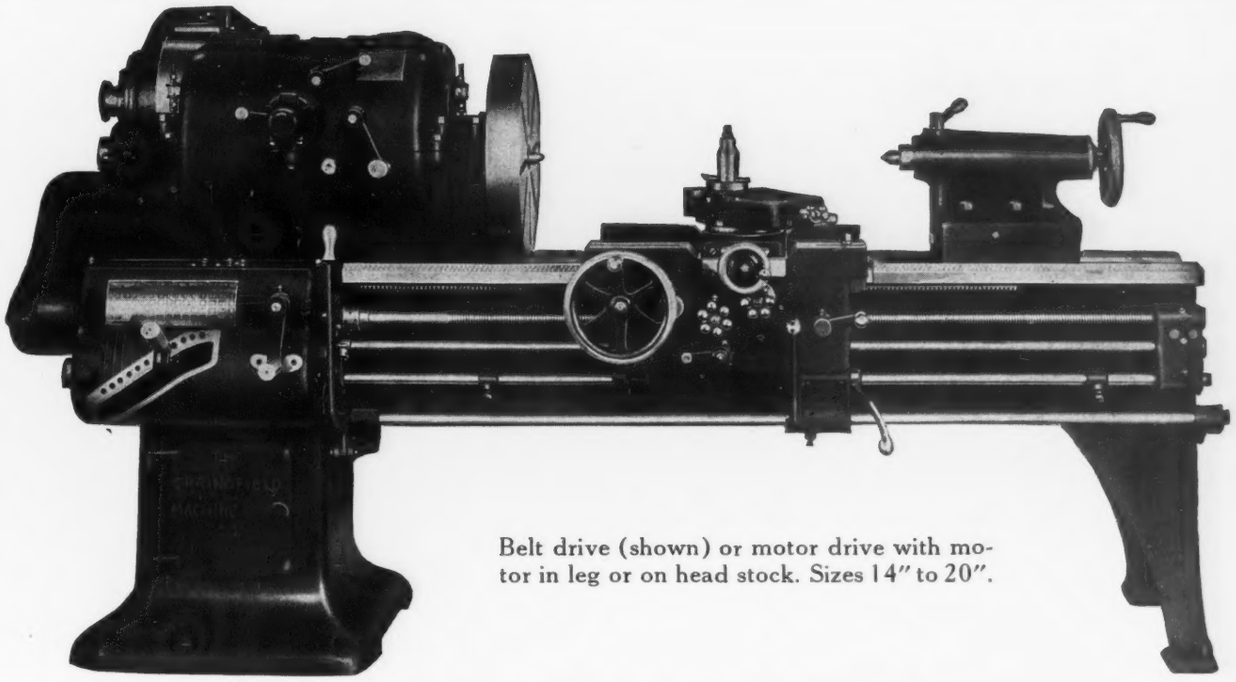
Single Clutch Showing Parts

Over 25 Years' Experience Assures YOU of Skilled Engineering Counsel

Four Step Cone Pulley mounted on Clutch Hub.

WRITE FOR CATALOG "A-8"

THE CARLYLE JOHNSON MACHINE CO. MANCHESTER CONN.



Belt drive (shown) or motor drive with motor in leg or on head stock. Sizes 14" to 20".

Proven Capabilities

Twelve speeds, directly selected, from 14 gears. No idle gears ever in mesh.

All journals (except main spindle) ball bearing, including thrust.

Noiseless and chatterless head, free from vibration.

Handy adjustment of main spindle bearing without removing cover or caps.

Concentrated control.

Greater accuracy—production. Less power consumption.

Springfield Lathes have proven their wide capacities for earning on every kind of work—in every kind of plant. Extremely wide range serves to keep them in constant operation in most shops, assuring a steady and profitable return on the investment.

Springfields are equally adapted for tool-room and production work. Accuracy and high speed capacity are ideally combined to make the Springfield particularly valuable in the one-lathe shop.

Get in touch with us for all details.

The Springfield Machine Tool Co.

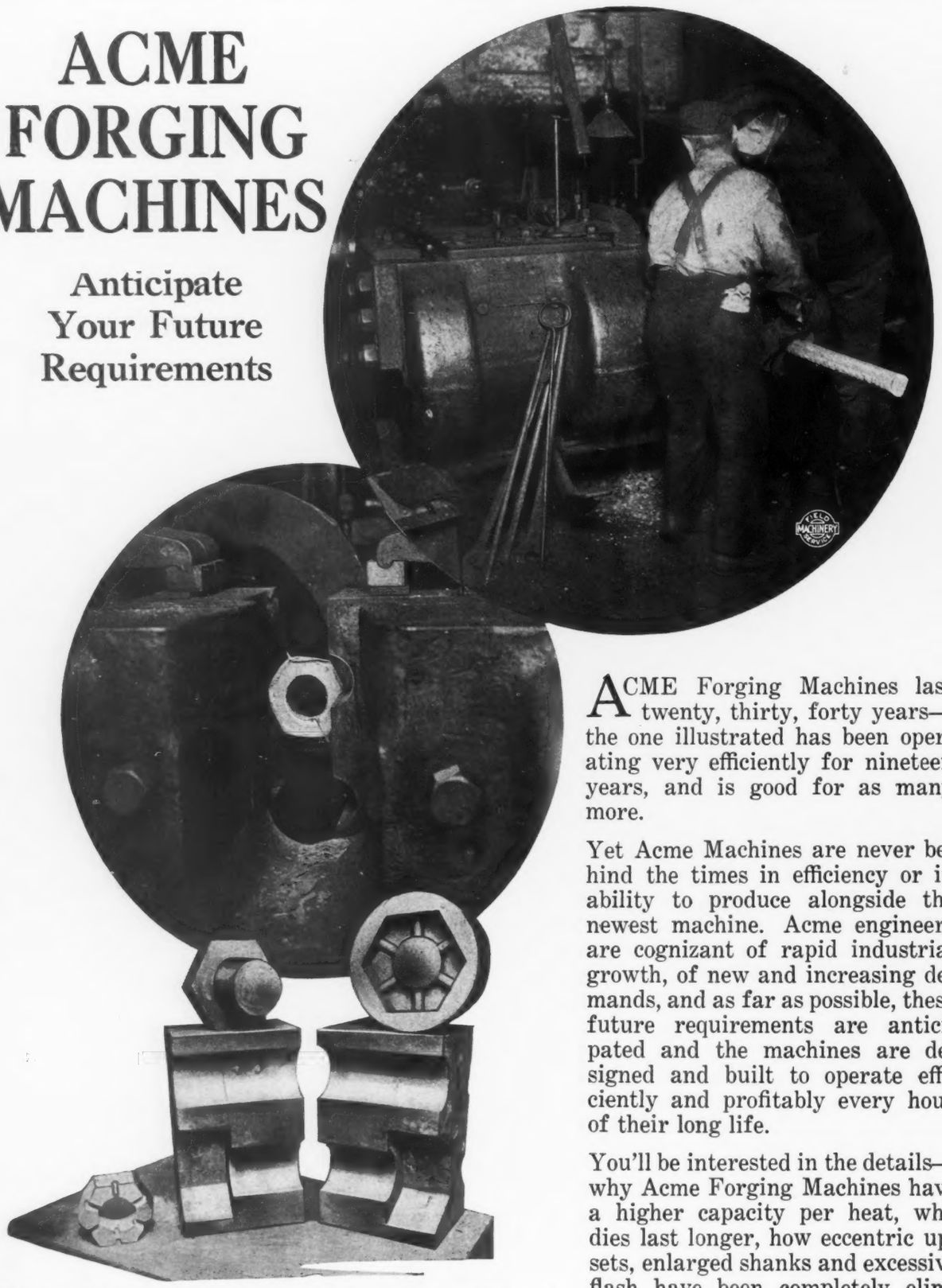
Manufacturers of Springfield Lathes and Shapers

631 Southern Avenue, SPRINGFIELD, OHIO, U. S. A.

SPRINGFIELD
Ball Bearing Geared Head
ENGINE LATHES

ACME FORGING MACHINES

Anticipate Your Future Requirements



This Acme Forging Machine has been in use in a large Eastern railroad shop for more than 19 years. When photographed castellated nut forgings were being made 3-13/16" across the flat, 1½" thick with a 2¼" hole. Wrought iron bar stock 2¼" diameter was used and a two-operation die makes a completed forging in one heat.

ACME Forging Machines last twenty, thirty, forty years—the one illustrated has been operating very efficiently for nineteen years, and is good for as many more.

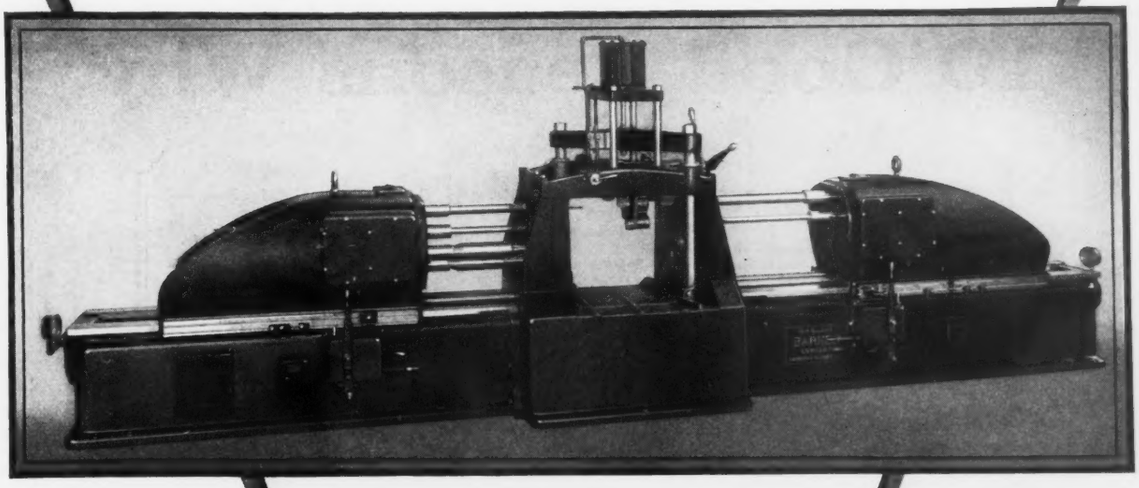
Yet Acme Machines are never behind the times in efficiency or in ability to produce alongside the newest machine. Acme engineers are cognizant of rapid industrial growth, of new and increasing demands, and as far as possible, these future requirements are anticipated and the machines are designed and built to operate efficiently and profitably every hour of their long life.

You'll be interested in the details—why Acme Forging Machines have a higher capacity per heat, why dies last longer, how eccentric upsets, enlarged shanks and excessive flash have been completely eliminated. Write us today for this information.

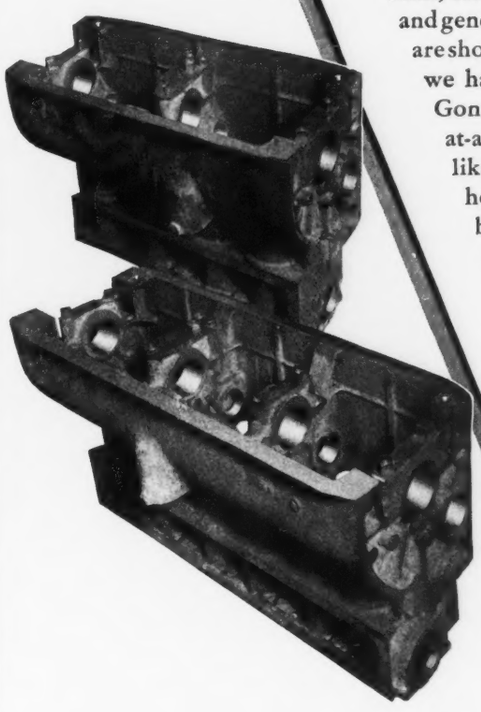
THE ACME MACHINERY COMPANY, Cleveland, Ohio

FOREIGN AGENTS: Burton, Griffiths & Co., Ltd., London; Glaenzer & Perreaud, Paris, France.

Motor Block Boring MACHINES



ILLUSTRATED is one of many Barnes horizontal machines for boring crankshaft, camshaft, water impeller holes and generator seats. At right and left are shown some blocks for which we have supplied equipment. Gone are the days of one-hole-at-a-time boring on work like this! Gone, too, the home-made multi-bar "rigging." Today it's Barnes boring and drilling for accurate high production.



by

W. F. and John Barnes Co.

ROCKFORD, ILLINOIS

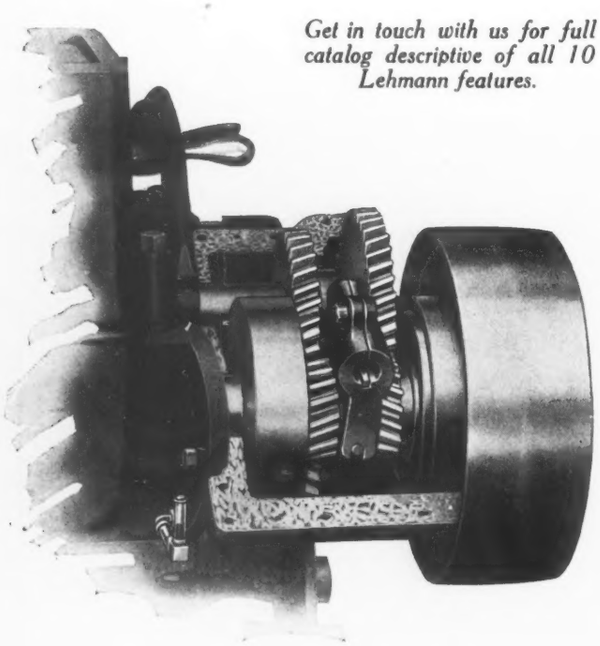
Established 1872

EXCEPTIONAL!

—and there are 10 Good Reasons Why

1. Improved Friction Clutch—Forward and Reverse—Running in Oil—Self Adjusting.
2. 16 Speed Headstock—Running in Oil—Simplicity of Construction — Only 10 Gears Required—All Gears Heat-treated or Hardened—All Shafts, except Spindle, Mounted on Ball Bearings.
3. Spindle — Alloy steel — Hardened and Ground. Patented Double Spindle Nose.
4. Bed—Deep and Wide—Braced by Large Cross-ribs—Chilled Ways.
5. Patented Quick Change—Wide Range—Central Oiling System.
6. Rod and Screw. Shift Positive—Safe.
7. Carriage Wide. Bridge Good Depth.
8. Apron—Double Plate Type—Removable Front Plate—Central Oiling System.
9. Apron Control of Clutch for Forward and Reverse—Similar Handle at Headstock End.
10. Improved Locking Device for Tailstock Spindle.

Get in touch with us for full catalog descriptive of all 10 Lehmann features.



THE Lehmann Friction Clutch is a patented feature. It has forward and reverse or brake, operates from a handle on the apron and from a similar handle at the headstock end of the bed.

Operating through helical spur gears, running in oil and mounted on shafts having ball-bearings, the clutch never requires adjustments and *will always pull a little more than the load imposed.*

Easy pick-up and a practical elimination of wear are assured by the displacement, upon engagement, of the film of oil covering cone surfaces. Forward and reverse engage readily and pick up easily under full load.

LEHMANN MACHINE COMPANY
3571 Chouteau Avenue
ST. LOUIS, MO.

The "LEHMANN"

An EXCEPTIONAL Engine Lathe

More Holes Per Grind

TESTING the steel we use, living up to accuracy standards of the most exacting kind, and using heat treating methods second to none in the country — certainly not the most inexpensive way to manufacture drills!

But that *is* the way to make possible inexpensive drilling. That is the way Morse Drills are made, and as a result they drill more holes per grind.

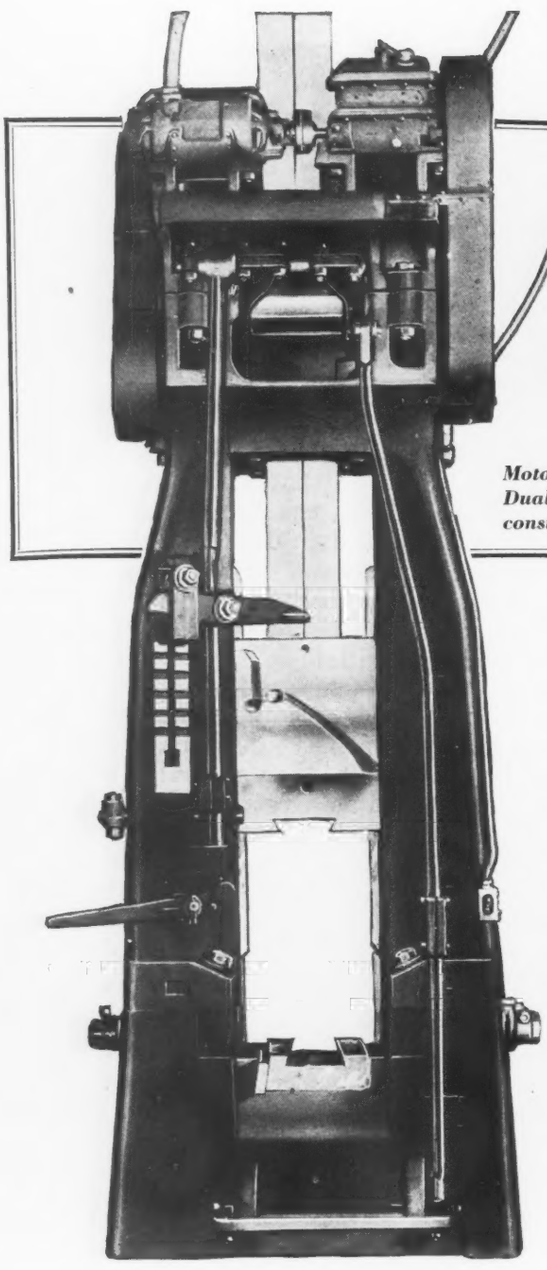
The Morse Line Includes

ARBORS CHUCKS DRILLS REAMERS
COUNTERBORES SCREW PLATES
CUTTERS TAPER PINS
MANDRELS SOCKETS SLEEVES
TAPS AND DIES

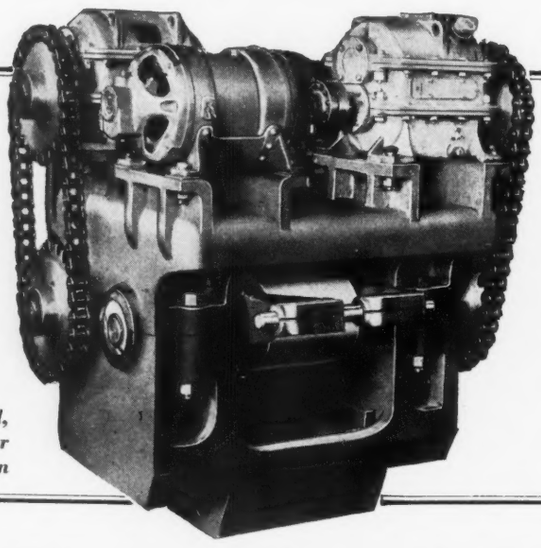
MORSE

TWIST DRILL & MACHINE COMPANY
NEW BEDFORD, MASS.

All Billings and Spencer Board Drop Hammers are now designed with Hyatt Roller Bearings as Standard Equipment ~



Billings Motor Driven Drop Hammer, built by The Billings and Spencer Co., Hartford, Conn., which, like their Belt Driven units too, are Hyattized at the positions of hardest wear.



Motor Head, Dual Motor construction

"WE have found," says Billings and Spencer, "that the use of roller bearings makes for several distinct advantages in the operation and in the life of the hammer. No piece of machinery is subject to harder wear and tear. Roller bearings eliminate friction, assure smoother operation, decrease the load on the motor, save power, and increase board life.

"In the actual life of the eccentric bushing, roller bearing advantages are manifested, and the additional cost of their installation soon justified. Furthermore a hammer, when well worn in, which would seem to be an old hammer, continues to have the vim and vigor of youth with roller bearing design as developed by Billings and Spencer."

Here you have the reasons why Billings and Spencer, as well as other builders of Drop Hammers, have standardized on Hyatt Roller Bearings. They are practically the same reasons which make Hyatts the preferred bearing for all equipment demanding similar long-lived, dependable performance from the component parts.

HYATT ROLLER BEARING COMPANY

Newark Detroit Chicago Pittsburgh Oakland

HYATT

ROLLER BEARINGS

PRODUCT OF GENERAL MOTORS

Continuous Production Milling

Wherever a mass production problem must be solved—for automobiles, refrigeration machines, vacuum cleaners, washing machines, electrical appliances—automobile and industrial plants everywhere are turning to NEWTON Vertical Continuous Millers—

because—you can definitely fix your rate of production and maintain it—day after day.

because—roughing and finishing can be done on the same machine, at the same time, without change of set-up.

because—intermittent quick traverse between cuts shortens operating time.

because—simplified control speeds up work and lightens labor for the operator.

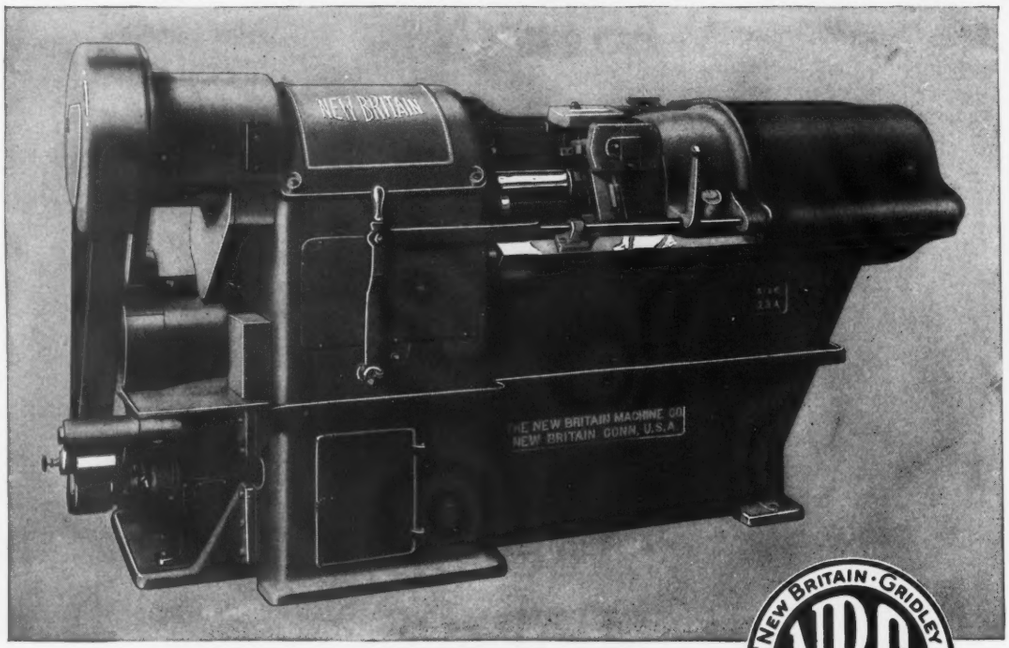
For complete information write for Bulletin 58-A

BETTS · NEWTON · COLBURN · MODERN · HILLES & JONES

CONSOLIDATED

CONSOLIDATED MACHINE TOOL CORPORATION of AMERICA, Rochester, N.Y.

Super Production



NEW BRITAIN AUTOMATIC CHUCKING MACHINE

SIZE 23A

A husky, fast, four-spindle Automatic Chucking Machine with AIR CHUCKS

Total rotating type

High speed production — obtained through reciprocation of light parts and individual *feed* of spindles. ¶ Turret indexes but does not reciprocate. Air chucks incorporated in turret enable operator to keep up with rapid index. ¶ Indexes up to 1250 per hour. Total idle time for spindle drawback, jump and turret index less than 1½ seconds. Seven-inch chuck capacity. ¶ Positive lead screw threading. Individual spindle speeds up to 1200 R.P.M. FORCE FEED lubrication throughout. ¶ Weight, 7000 lbs.

THE NEW BRITAIN-GRIDLEY MACHINE CO.

NEW BRITAIN, CONN.

GARVIN 2X

AUTOMATIC TAPPING MACHINES

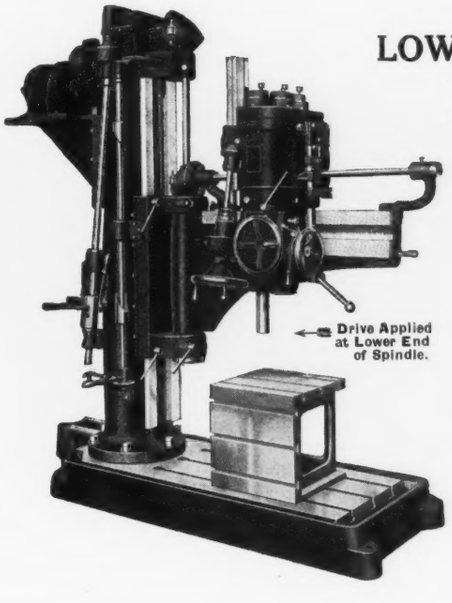
with Timken Tapered Roller Bearings and Timken Bearing Equipped Four Change Speed Box

Speed, accuracy, operating economy and production *without tap breakage* have earned for Garvin 2 X Automatic Tappers an enviable reputation for production efficiency.

Provision for accurate clutch adjustment and positive spindle alignment, Timken Roller Bearings throughout, hardened chrome nickel gears in the new selective type speed box (which may be supplied for Garvin Tappers already in service) are features that contribute to Garvin reputation and results.

WESTERN

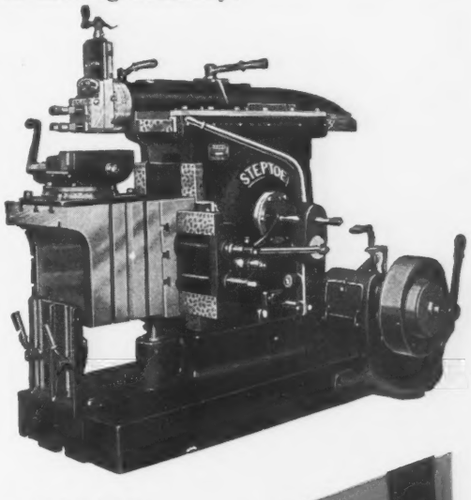
LOW HUNG DRIVE RADIAL DRILLS



Equipped with Timken Roller Bearings

Power where you need it insures an efficient drive without waste and without torsional strain on the spindle; Timken Tapered Roller Bearings guarantee the vibrationless chatter-free service that insures drilling accuracy.

STEPTOE SHAPERS

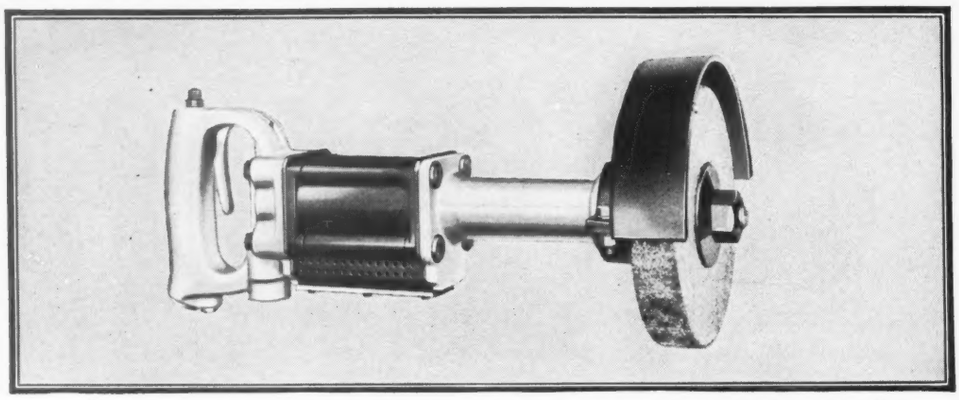


With Timken Roller Bearings

Timken Roller Bearings to carry the driving strains enable Steptoe Shapers to deliver power, speed, *production* without strain and with minimum machine wear; convenient control is also a Steptoe feature; for instance, adjustment of the ram stroke can be made while the machine is in motion—other machines have to be stopped to accomplish this.

Send for details of the carefully selected Western Line of production machines.

WESTERN MACHINE TOOL WORKS
HOLLAND, MICH., U. S. A.
Cable Address: "Western" Holland



Announcing New Models of Rotor Air Tools

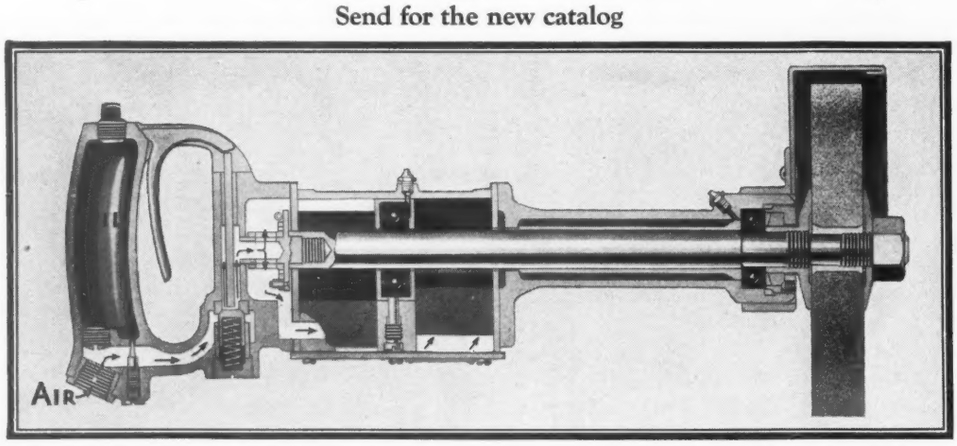
Greatly increased power from new rotors

New governor maintains maximum working speed, reduces air consumption

and still— —

the lightest in weight
the best balanced
and the cheapest to maintain

Send for the new catalog



The Rotor Air Tool Company, Cleveland, Ohio

Foreign Factory Representative: Gaston E. Marbaix, Ltd.
Adelaide House, King William Street, London, E. C. 4, England

GRINDERS • BUFFERS • SANDERS • DRILLS

Rotor Air Tools

PLANAMILLING

Elongated Bearing Holes in Crankshaft End of CONNECTING RODS

The Work

Still another Planetary production operation of interest to automotive manufacturers.

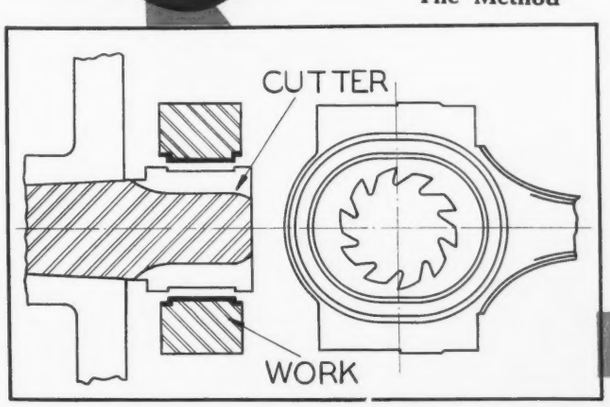
This connecting rod is forged in one piece, with the crankshaft bearing hole somewhat elongated—as shown in the drawing below. *After this hole is Planamilled to size in one operation* it is cut through on a cold saw—the saw cut being just wide enough to take off the extra metal and leave two half rounds that when bolted together form a sufficiently accurate bearing hole.

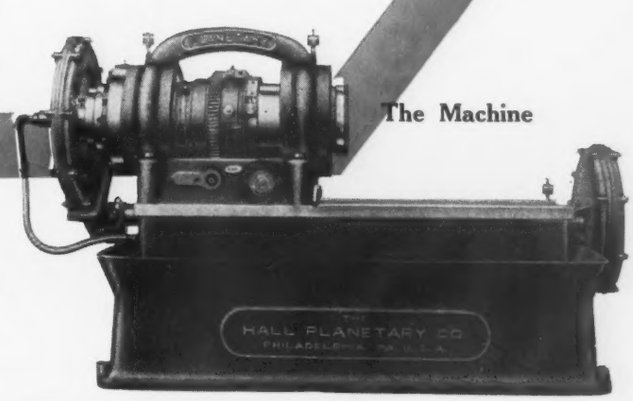
Thus another "problem job" is reduced to the utmost in mechanical simplicity; another automotive production operation is greatly reduced in cost.

Planetary Production—Planamilling, Planathreading—offers untold possibilities of cost reduction in the industrial as well as the automotive field.

The Planetary Booklet describing the Method, the Range, the Results—*illustrated by operation photographs*—should be in your files. May we send it?

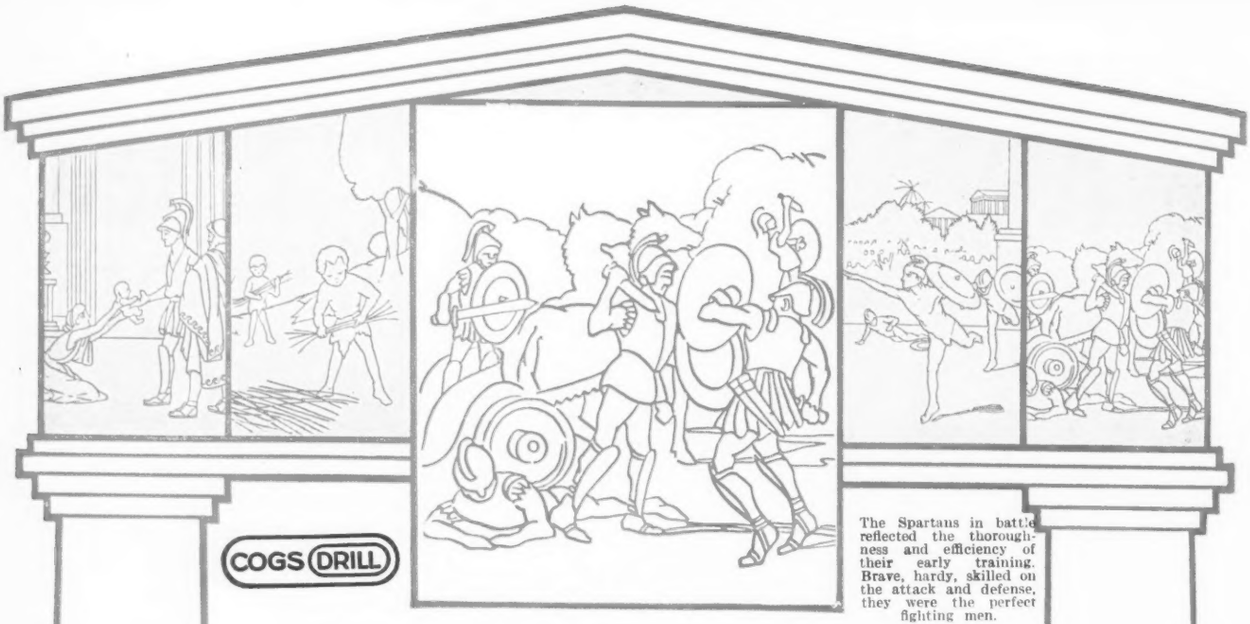
The Method





The Machine

The Hall Planetary Co.
Fox St. and Abbotsford Ave.
Philadelphia, Pa.



COGS DRILL

The Spartans in battle reflected the thoroughness and efficiency of their early training. Brave, hardy, skilled on the attack and defense, they were the perfect fighting men.

The Endurance and Bravery of the Spartans Find a Modern Counterpart in Cogsdill Tools

Spartan valor and fortitude are traditional. As children we all thrilled to the story of the Spartan lad who, rather than cry out in pain, permitted the fox he had secreted in his clothing to gnaw him to death. And later, we saluted the gallantry of Leonidas and his handful of Spartans, holding the pass of Thermopylae against Xerxes and his Persian horde.

These wonderful deeds demanded stamina. And so too—and in no lesser degree—do the jobs performed daily by Cogsdill Tools in industrial plants everywhere. These drills, reamers, counterbores, cutters and special tools have established records for production, precision and economy on every kind of work that has earned the standardization of leaders in all lines.

Cogsdill superiority comes, not from chance, but from the influence of intelligent designing, careful building and skilled manufacturing with the most modern equipment that money can buy.

Enlist these Spartans of Industry for your battles of production.

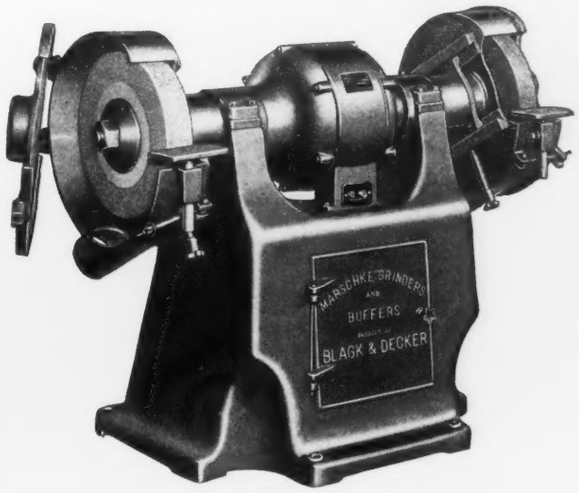
COGSDILL MANUFACTURING CO.

DETROIT, MICHIGAN

This is the KEY of the GOOD GRINDING FRATERNITY

MARSCHKE
PRONOUNCED
MARSH-KEY
GRINDERS AND BUFFERS

PRODUCT OF
BLACK
&
DECKER

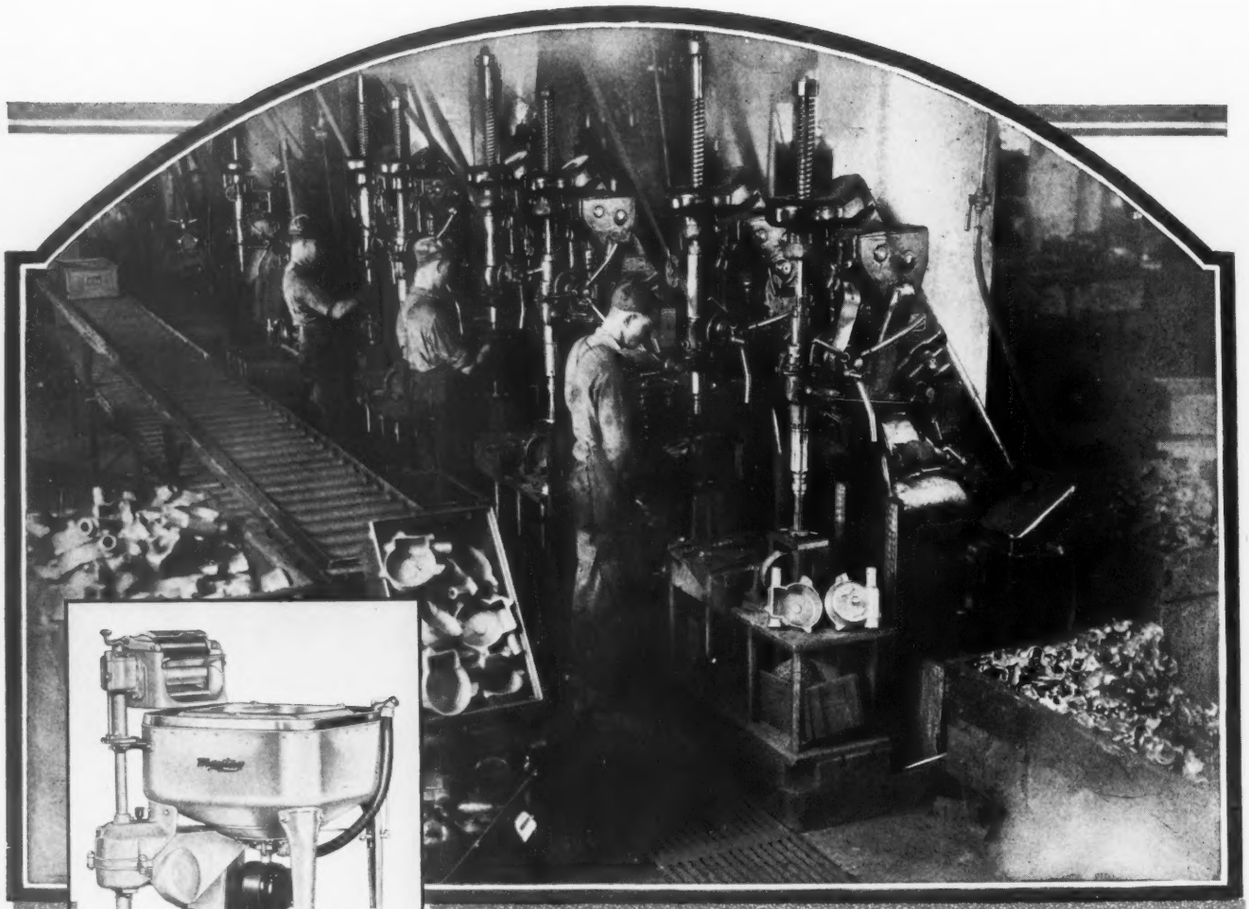


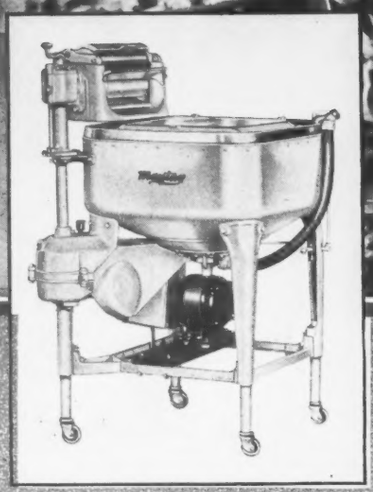
Definitely superlative advantages are necessary to provide a grinder with distinction enough to make it an outstanding machine; to give its user the knowledge that without doubt he has at his command grinding equipment that will perform every assignment with utmost efficiency.

You will find just such a machine, well suited to your requirements, in the complete Marschke (Marsh-Key) line of Grinders, Swing Frames and Buffers. Those machines are manufactured by Black & Decker, who build them to the same high standards that always have characterized Black & Decker Portable Electric Tools.

The Marschke *Key* symbolizes the best in grinding. Your copy of the Marschke booklet, with Key attached, gives the complete story. Send for it.

MARSCHKE MANUFACTURING CO., Towson, Maryland
GRINDER DIVISION OF BLACK & DECKER





"Punching Holes by a Rotary Process" at Maytag

COMMENTING on what he had seen, a recent visitor to the Maytag Company, Newton, Iowa, said, "They use the highest speeds and feeds I have seen anywhere; their drilling is really *punching holes by a rotary process.*"

Illustrated is the latest model Maytag Washing Machine and three 2-spindle High Production Units which are part of the 45-spindle Self-Oiling, All-Geared installation in the Maytag plant. This picture was first published in October, 1927. The Units shown are running along steadily turning out an enormous quantity of work—and recently they have been joined by several of our No. 242's.

A glance at our records shows shipments of Self-Oiling, All-Geared equipment to practically all of the washing machine manufacturers. One of these installations increased production more than 800%! Here is a record of achievement in a field where a product must be durable, dependable, low in price—and competition is keen. Self-Oiling, All-Geared machines, if not a necessity, are certainly a highly profitable investment for these manufacturers. In other fields—similar records. And how about *you?* Get our catalog and look it over, anyway.

Ask for Catalog "M"

Barnes Drill Co.

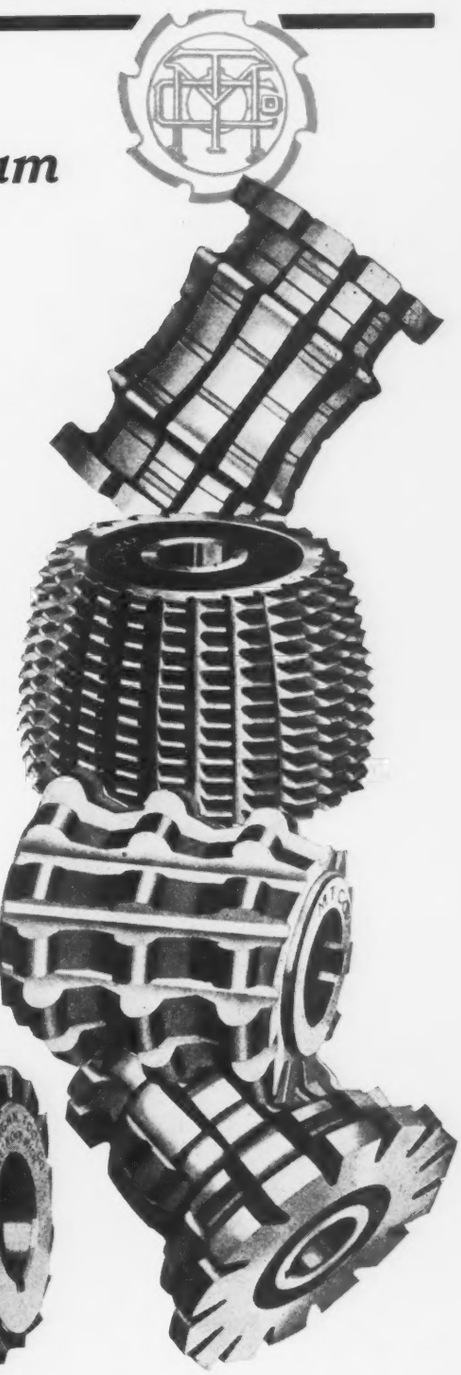
814 Chestnut Street, Rockford, Ill.

MICHIGAN

Correct Design for Maximum Cutting Efficiency

Correct design of cutters and hobs means faster production, greater durability and sometimes makes it possible to reduce machining operations and so greatly reduce production costs.

Michigan Cutting Tools are correct—correctly designed, made of the right steels, correctly heat treated. Michigan production facilities and experience insure economy and prompt deliveries. Let us estimate.



Products of the Michigan Tool Co.

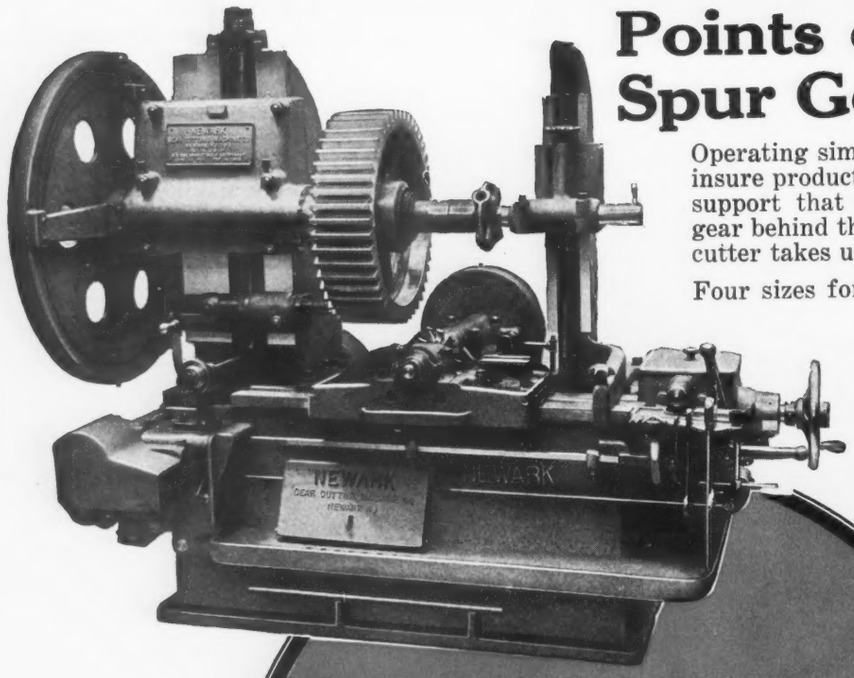
- Hobs (Ground and Unground)
- Gear Shaper Cutters
- Spline Shaft Hobs
- Single Purpose (Involute) Gear Cutters
- Milling Cutters (All Types)
- Ground Thread Taps
- Thread Milling Hobs
- Formed Tools for Screw Machine Work

Tool Engineering Service and Complete Catalog on request.

Michigan Tool Company, Detroit, Mich., U.S.A.

REPRESENTATIVES:

J. W. MULL, JR., 426-427 Board of Trade Bldg., Indianapolis, Indiana.
C. M. CONNER, 1701 Arch St., Philadelphia, Pa.
CAMM BLADES MACHINERY CO., 610 Michigan St., Milwaukee, Wisconsin.
E. O. JENKINS, 408 Robineau Road, Syracuse, N. Y.
J. M. DAVIE, 3130 East Overlook Rd., Cleveland, Ohio.
R. T. MONAHAN, 1525-29 Arcade Bldg., St. Louis, Mo.
H. E. EATON, 50 Church Street, New York, N. Y.
OSCAR LORANGE COMPANY, National Bank Bldg., Waltham, Mass.
EVANS TOOL COMPANY, 335 South Central Ave., Los Angeles, California.
DAVIS-JONES MACHINERY, 724 West Washington Blvd., Chicago, Illinois.
W. S. MURRIAN CO., 1509 The General Bldg., Knoxville, Tennessee.
J. B. MORRISON MACHINERY CO., 1977 Dufferin St., Toronto, Ontario.



Points on Newark Spur Gear Cutters

Operating simplicity, mechanical correctness insure production efficiency. A special thrust support that bears against the run of the gear behind the cut but out of the way of the cutter takes up the cutting strains.

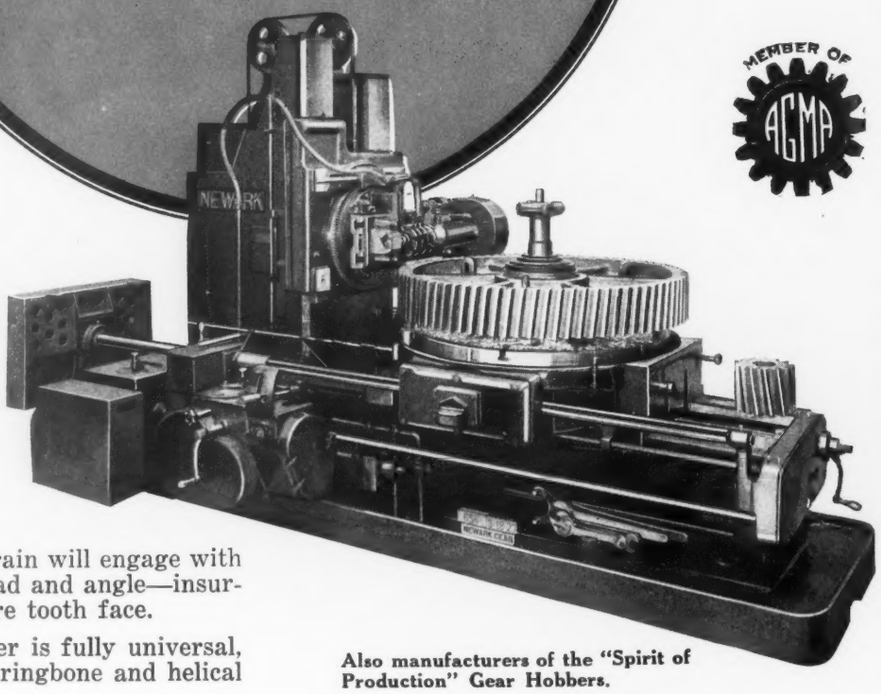
Four sizes for gears, from 36″ diameter by 10″ face, to gears 100″ diameter by 24″ face.

The NEWARK No. 0 CUTTER SHARPENING MACHINE for disk cutters to 10″ diameter, is the proper companion for the Newark Spur Gear Cutting Machines.

NEWARK GEAR PRODUCTION MACHINES

MEMBER OF AGMA

Hobbing Helical Gears



A simple operation on the Newark No. 5 Gear Hobbing Machine. Work is easily set up, cutting is automatic with automatic trip when the job is done. This machine does not require resetting of the lead gears for changing from large gear to pinion. It insures absolute duplication in cutting angles—all gears in a train will engage with perfect alignment both as to lead and angle—insuring full bearing along the entire tooth face.

The Newark No. 5 Gear Hobber is fully universal, hobbing spur, worm wheel, herringbone and helical gears with equal efficiency.

Send for details of Newark Gear Cutting Machines.

Also manufacturers of the "Spirit of Production" Gear Hobbers.

(Makers of Gear Cutting Machinery for a Quarter of a Century.)

NEWARK GEAR CUTTING MACHINE COMPANY

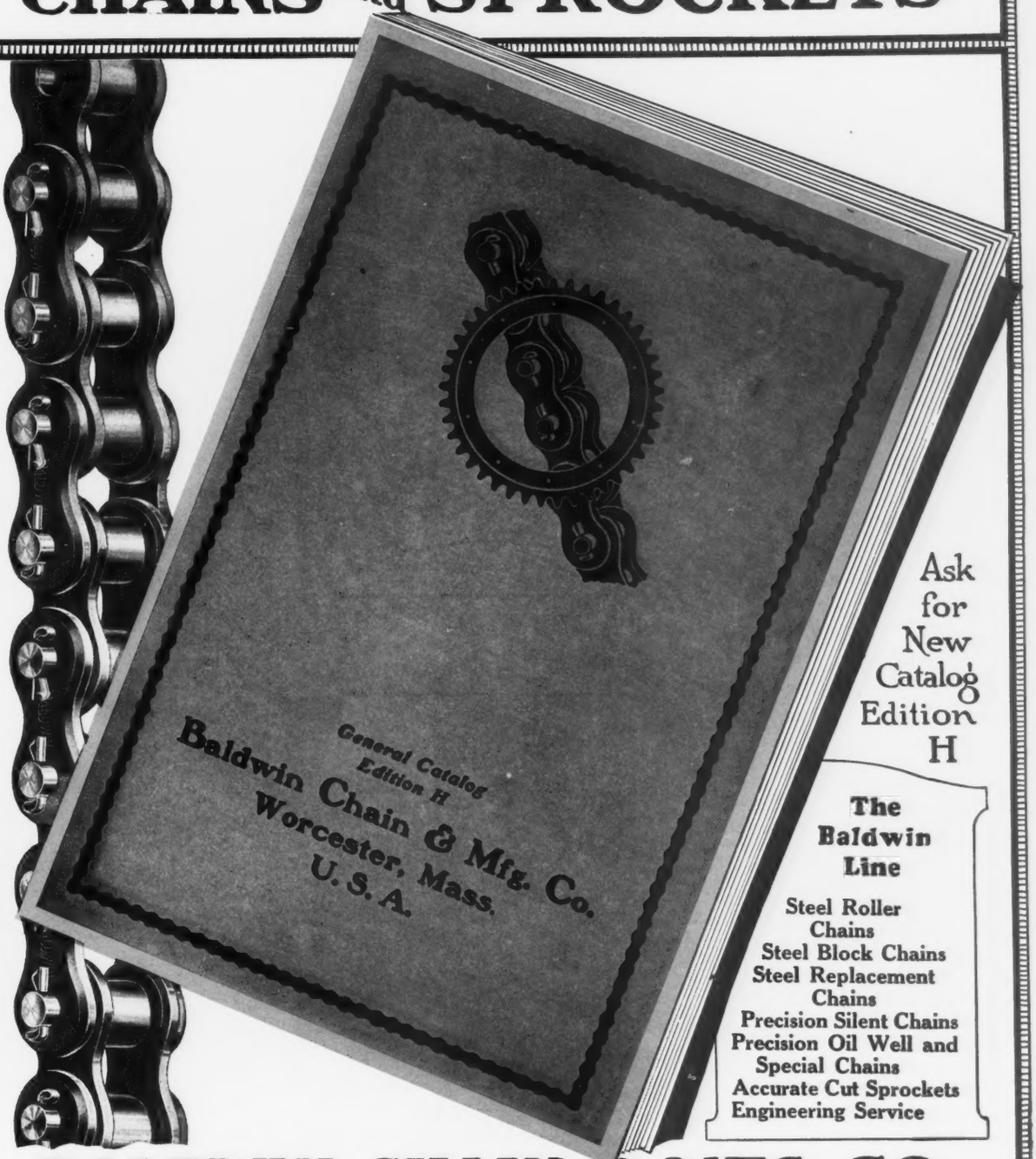
Henry E. Eberhardt, President. Phone: 7725

69 Prospect St., Newark, N. J., U.S.A.

BALDWIN

Since 1896

POWER TRANSMISSION CHAINS and SPROCKETS



Ask for New Catalog Edition H

The Baldwin Line

Steel Roller Chains
Steel Block Chains
Steel Replacement Chains
Precision Silent Chains
Precision Oil Well and Special Chains
Accurate Cut Sprockets
Engineering Service

BALDWIN CHAIN & MFG. CO.

Worcester, Mass., U.S.A.

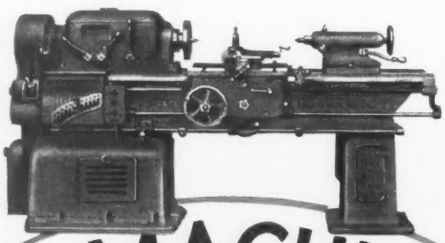
HENDEY

Profits — Production — Service Satisfaction

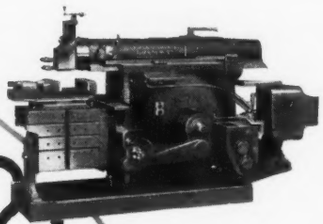
Three things every manufacturer wants *and gets*—when he installs Hendey equipment.

Hendey Machines are fundamentally correct and kept constantly up-to-date by the improvements and developments inaugurated whenever desirable by Hendey engineers.

Remember it takes quality to produce quality and Hendey has it in design, construction and service capacity.



Send for details of Hendey Production Equipment



See Hendey Products at Booth 1D2, the N. M. T. B. A. exposition in Cleveland, Sept. 30th to Oct. 4th.

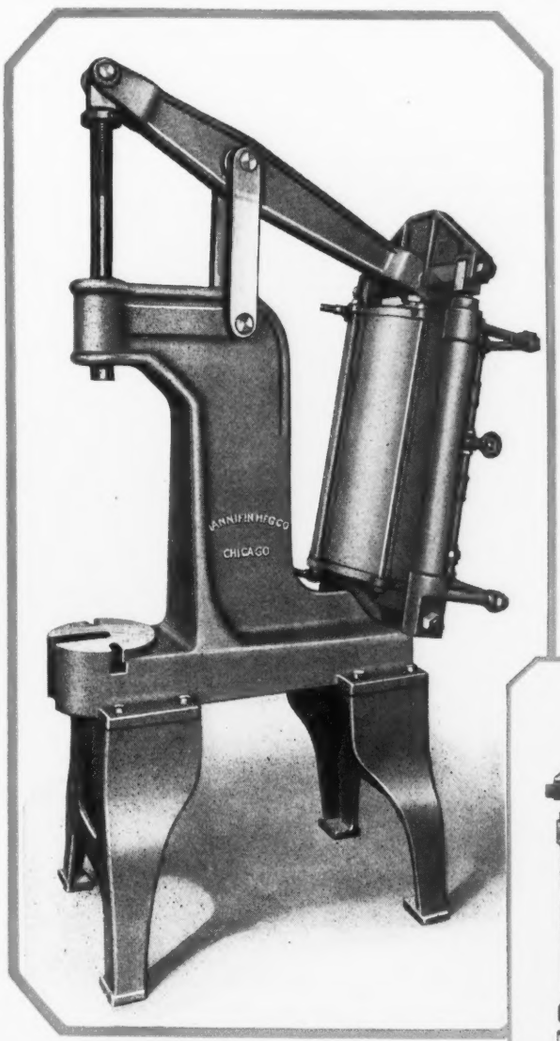
Singer Bldg., New York City
Commerce Bldg., Rochester, N. Y.
565 Washington Blvd., Chicago, Ill.
1534 Dime Bank Bldg., Detroit, Mich.
1226 First National Bldg., Dayton, Ohio.

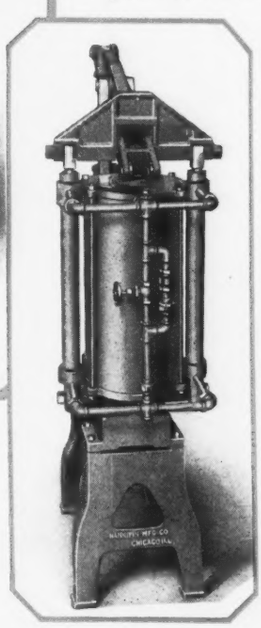
625 Broached Holes Per Hour

with a

HANNIFIN

Hydro-Pneumatic Broaching Press





The following example of Hannifin Hydro-Pneumatic Broaching is not an exceptional but a *typical* instance of the efficiency of this equipment:

The manufacturer of a well-known hydraulic shock absorber inserts valves in a 9/16″ diameter hole that is 1″ in length, running through the cast-iron body of the absorber. This hole must be straight, round and perfectly smooth, and must in addition be held to very close limits. It was formerly attempted to ream the hole, but this process was unsatisfactory in that production was comparatively small. Also, it was practically impossible to keep the finished job within the required limits of accuracy. A hydraulically operated broaching machine was resorted to, but with this equipment it was impossible to obtain better than three hundred parts per hour, which was insufficient.

Now, with a No. 2 Hannifin Air Operated Arbor Press with Oil Cylinder Speed Control, this manufacturer is getting production in excess of 625 parts per hour on an average daily run. And, in addition, such perfect results are being obtained with this method—finished diameters being held to such close limits—*that rejects have been entirely eliminated.*

Write for General Catalog which illustrates and describes Hannifin Air-Operated Production Equipment.

Hannifin Products—

Standard Air Operated Chucks
Special Air Operated Chucking Devices
Air Operated Clamping Devices
Air Operated Expanding Mandrels
Air Operated Presses
Air Operated Jigs and Fixtures
Rotating Double-Acting Air Cylinders
Stationary Double-Acting Air Cylinders
Air Operated Vises
Air Control Valves for all Purposes
Air Operated Riveting Presses
Air Clutch Countershafts

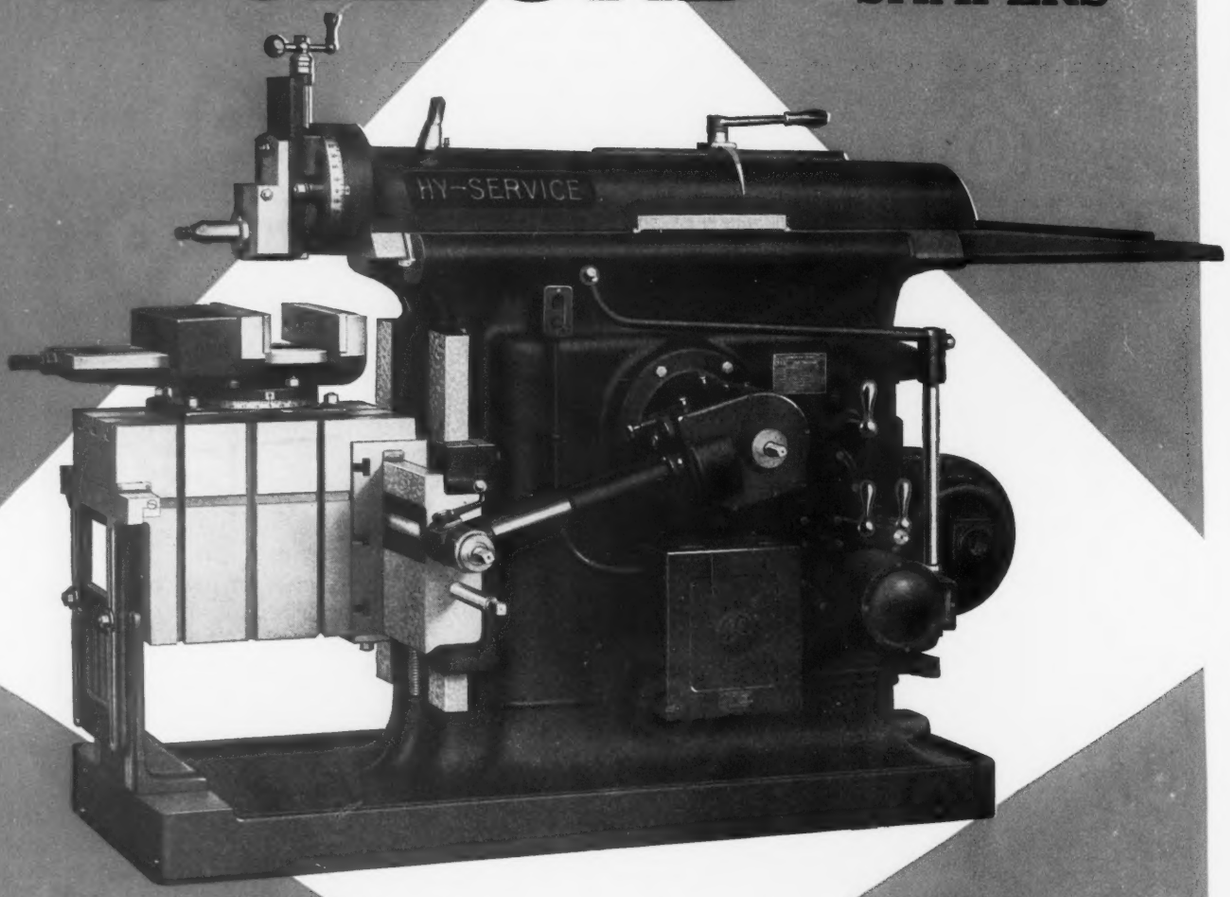
HANNIFIN
AERO CHUCKS
M'F'G. CO.
CHICAGO

HANNIFIN MFG. COMPANY

621-631 S. Kolmar Ave. **CHICAGO, ILL.**

GREAT BRITAIN—Coats Machine Tool Co., 14 Palmer St., London, England. GERMANY—George Stenzel Co., Frederick Strasse, Berlin, Germany. FRANCE—Fenwick Freres Co., 8 Rue De Rocroy, Paris, France.

ROCKFORD HY-SERVICE SHAPERS



Ideal Equipment for the Tool Room or Production Line

Features

Heavy Construction, Self-Contained, Powerful—Accurate Convenient Controls.

Motor or Single Pulley Drives.

Twin Disc Clutch and Brake.

Timken Roller Bearings.

Self Lubrication, 16"-20"-24" Heavy Models.

20"-24"-28" Standard Models.

Speed — as much as you can handle; accuracy—more than ever before possible with a similarly adapted tool. Thus is the Rockford Hy-Service Shaper available for every requirement of the average shop.

The power is there — protected by a design unmatched in ruggedness, and capitalized to the full by a method of control and adjustment that greatly simplifies operation.

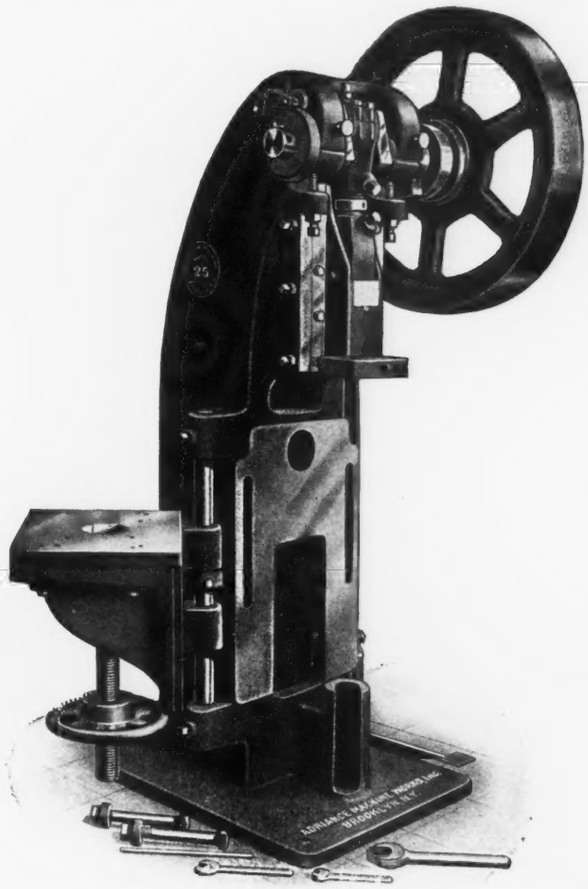
Timken Roller Bearings throughout assure a light, long-lived drive. Alloy steel shafts and gears, heat treated (running continuously in an oil bath), typify the fine grade of material used in construction.

Hy-Service Shaper equipment assures high profits. Get our catalogs.

ROCKFORD MACHINE TOOL COMPANY

2400 Kishwaukee Road :-: :-: ROCKFORD, ILL.

"ADRIANCE"



The Verner Steel Products Co.,
1928 Monterey Avenue, Chicago, Ill.

PACIFIC COAST REPRESENTATIVES:
C. F. Bulotti Machinery Co.,
829 Folsom Street, San Francisco, Cal.

Western Machinery Exchange,
Santa Fe Ave. at 9th St., Los Angeles, Cal.

Buck and Hickman Ltd., 2 Whitechapel Road, London, Sole agents for Great Britain

This type of press will be found useful where large space is required between bed and slide, the adjustable table allowing the use of dies of extra height. Adaptable for the various operations of Horning and Wiring, for grooving or closing the side seams on round, square or oval cans and for operating wiring dies. These presses will also be found useful for blanking, combination and forming die work.

Double Bumping Horns for closing the two side seams of 5-gal. cans at one operation, may be attached to these presses.

ADRIANCE MACHINE WORKS, INCORPORATED

78 RICHARDS STREET, BROOKLYN, N. Y.

Please send copy of "Adriance" Bulletin No. 6.

Name..... Address.....

SLOCOMB

Slocomb Micrometers and Slocomb Center Drills are made in sizes for every need. Let us send the complete catalog.

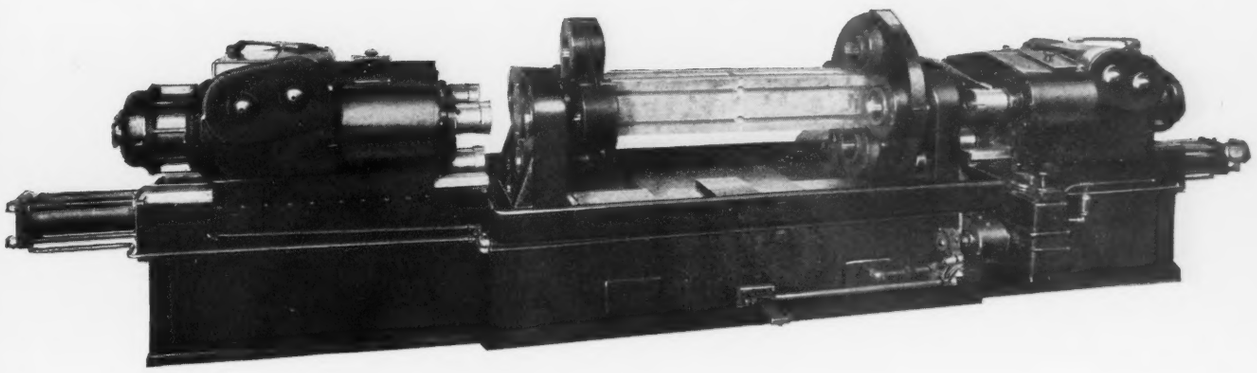
"Time-Tried"

Slocomb Tools are "time tried"—they have been the choice of experienced machinists for over twenty-five years; they are standard in many shops from coast to coast. It's the removable tool steel spindle, accurately fitted — that has given the Slocomb Micrometer the title — "The Longest Lived Micrometer that can be bought."

The Slocomb Center Drill, the original center drill combining drill and countersink of alloy steel, is another tool worthy the name Slocomb which you will find stamped on it.

J. T. SLOCOMB CO.
PROVIDENCE, R. I.

PRODUCTION!
PRODUCTION!
PRODUCTION!
Of Ever Increasing Importance



ONE OF
OUR CONTRIBUTIONS:

Illustrated, contributes toward Better and Greater Production in machining large REAR AXLE HOUSINGS.

ONE CONTROL operates both boring heads simultaneously, giving Rapid Traverses in both directions and proper Feeds, as desired.

PROGRESSIVE OPERATIONS performed are those of Roughing, Semi-Finishing and Finishing the Counterbores for Bearings at each end of the housings.

INDEXING DRUM TABLE with four sides, for accommodating Fixtures, permits the following operations at each forward and return traverse of boring heads: Unload and Load housing at top side,—Rough Counterbore housing at back side,—Semi-Finish Counterbore housing at bottom side,—Finish Counterbore housing at front side. Thus at each index of the table, operator unloads a housing with counterbores finished and starts a new unfinished housing through the progressive operations.

CONSTRUCTIONAL FEATURES of greatest importance,—Motors driving directly into each head through Worm and Worm Gear reduction, Pick-Off Gears for Speed Changes. Ample size carefully scraped Ways. Timken Bearings used throughout for mounting Drives, Spindles and Drum Table. Ample lubrication facilities provided. Oilgear Feed.

ADAPTABILITY for Multiple Drilling, Boring or Tapping operations of great variety possible with ROCKFORD equipment. Same construction used for Single-End, Double-End, Three or Four Way Horizontal arrangements, also Vertical and combinations of Vertical and Horizontal. Suited to special requirements and yet incorporating considerable flexibility.

PROPOSALS for increasing your production on similar operations will be gladly submitted on receipt of prints and details covering requirements.

THE ROCKFORD DRILLING MACHINE Co. ROCKFORD ILL. U.S.A.

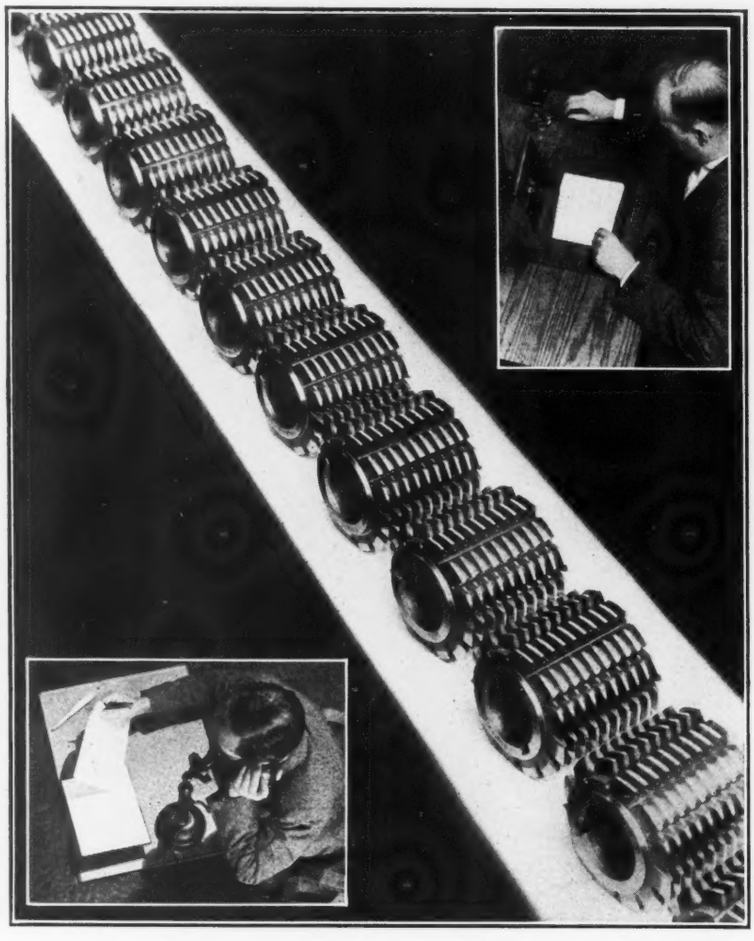
ROCKFORD DRILLING MACHINE COMPANY
209 Catherine St., Rockford, Illinois

BARBER-COLMAN

....quality products....

"SERVICE"

"DEPEND-ABILITY"

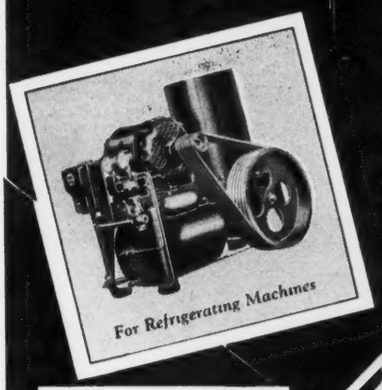


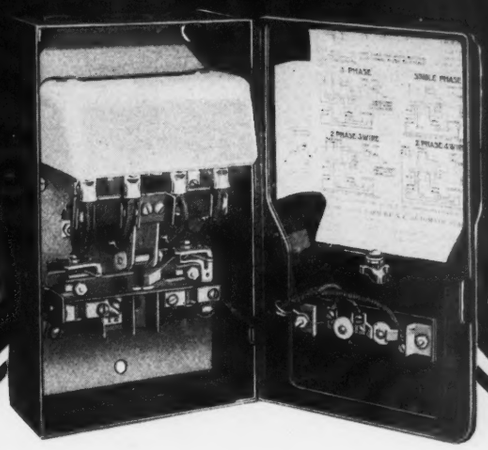
Two words that carry Weight

FROM all points of the compass—from large and small factories in every section of North America, and from many of the manufacturing centers in lands across the sea—orders often come by telephone, by telegraph, or by cable. A dozen hobs, a special milling cutter, or a machine *must* be delivered *quickly*. We are ready for such emergencies with an organization that is trained to care for these occasional "Rush" jobs efficiently. And we put the same integrity of materials and manufacturing accuracy into *every* Barber-Colman product—Rush or Regular. So, when you need it, you can get genuine SERVICE with full DEPENDABILITY from Barber-Colman. May we supply you?

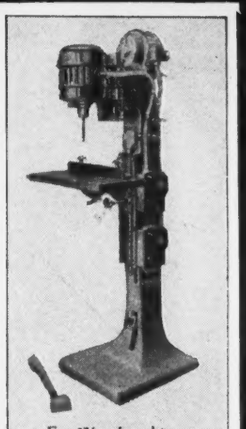
BARBER-COLMAN COMPANY

General Offices and Plant, ROCKFORD, ILL., U. S. A.


For Refrigerating Machines



For Oil Burners

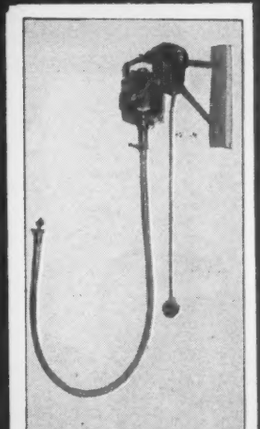

For Woodworking Machinery

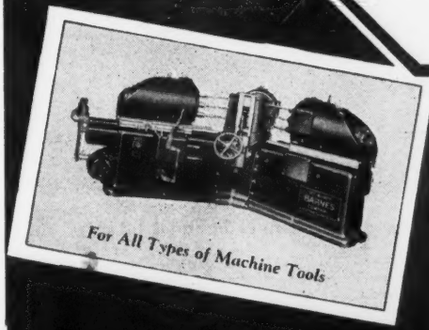
HERE is a rugged little A. C. starter that can take a lot of vicious punishment — and come back for more!

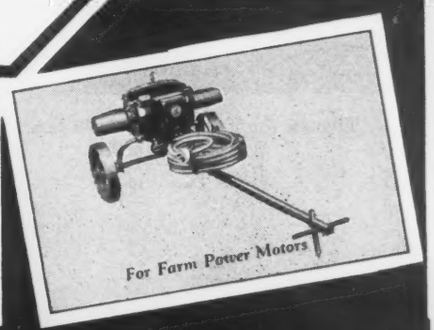
It's a thoroughbred, right from the marvelous arc hood that annihilates every arc, down to the Resisto-therm overload relays that trip with faultless accuracy. That's not sales talk — it's the experience of thousands of users.

Machinery builders, who want to guarantee continuous satisfaction from their machines, use the starter that has *a big reserve for extraordinary demands*. If you want to find out how much reserve there is in a 709, drop us a line, and the next mail will bring a 709 for test and trial. No fuss — no obligation.

ALLEN-BRADLEY CO.
499 Clinton St., Milwaukee, Wis.


For Every Type of Grinder

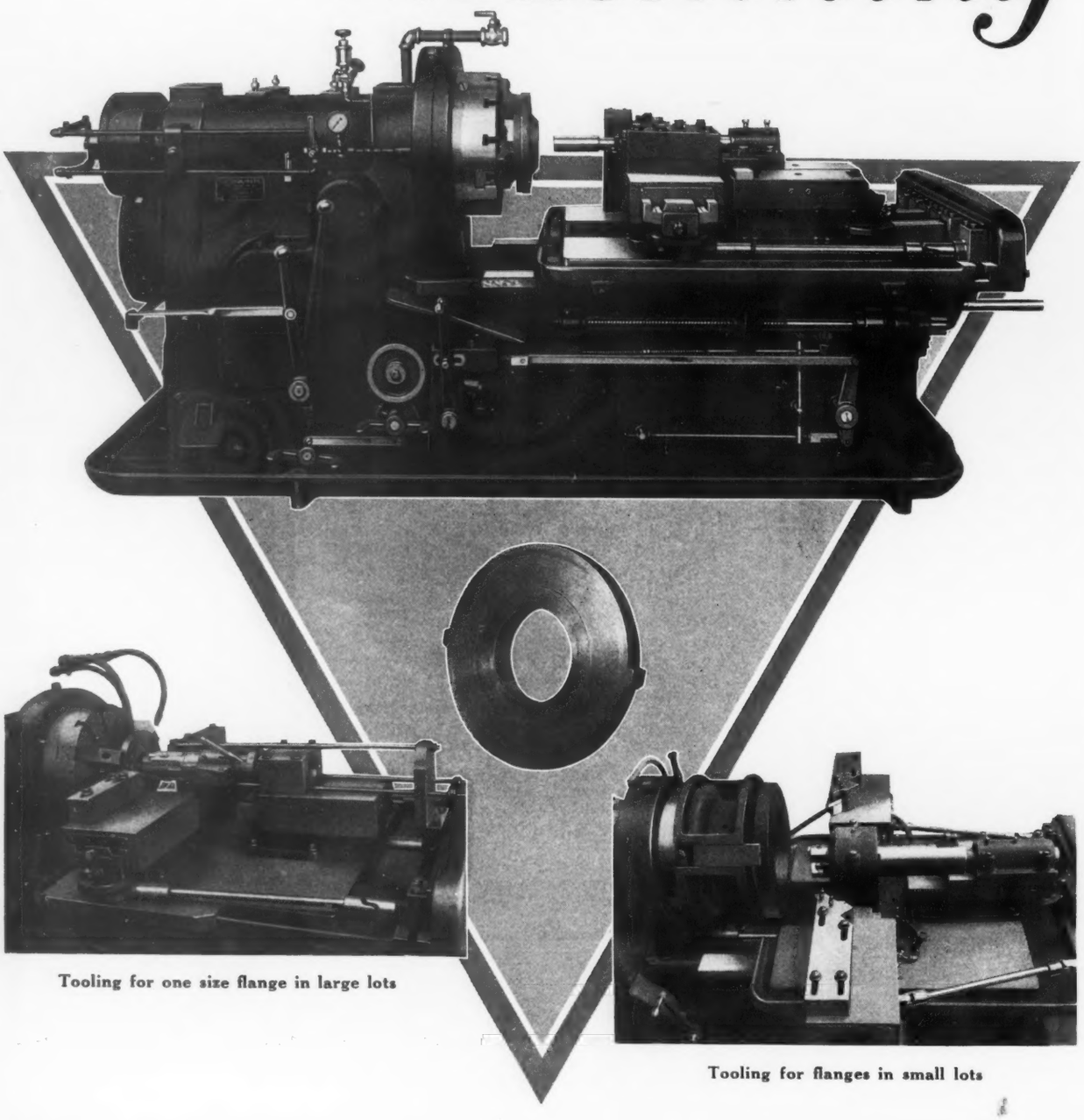

For All Types of Machine Tools


For Farm Power Motors

Allen-Bradley

Bulletin 709 Starter

Machining



Tooling for one size flange in large lots

Tooling for flanges in small lots

GISHOLT

To Increase

Machine Design Service / **Tool Design Service** / **Field Production Service**

Pipe Flanges

on the
IMPROVED SIMPLIMATIC

EQUIPPED with a three-jaw air chuck, pump and three slides, the Improved Simplimatic is an ideal automatic machine for facing, boring and threading pipe flanges of cast iron or steel. It is especially effective on sizes from 4″ to 12″ inclusive. Changing from one size to another is accomplished readily and quickly. This convenience and adaptability is highly profitable when a number of different sized flanges are to be finished in small lots. Under these conditions a boring tool followed by a chaser is used. Both tools are carried in one bar which is set to the angle of the taper thread. This equipment may be used for any size pipe flange, the substitution of different chasers as required being the only change necessary.

Production of a large lot of flanges, all the same size, is facilitated by the use of a special tool for boring and threading that size only. This equipment is set at right angles to the flange face and comprises a set of boring tools followed by a set of chasers, both of which expand as they feed into the work thus forming the required threaded taper.

All manufacturers of pipe flanges and similar parts are invited to investigate the profit producing possibility of the *Improved Simplimatic.* The cooperation of Gisholt Simplimatic specialists is always available.

Write to Dept. 12

GISHOLT MACHINE COMPANY
1201 E. WASHINGTON AVENUE
MADISON, WISCONSIN

Your Chucking Profits

Heavy Turret Lathes | **Small Turret Lathes** | **Automatic Chucking Machines** | **Balancing Machines** | **Tool Grinders**

FAFNIR
BALL BEARINGS

THE MOST COMPLETE LINE OF BALL BEARINGS IN AMERICA

Vibrationless... Quiet *at 5700 R.P.M!*

—Rotor Air Tools maintain peak production on Fafnirs

RUNNING at top speed, hours on end, in a fine shower of abrasive grit . . . such service demands the toughest, most true-running and friction-free bearings. For under these conditions, any bearing flaw would crop out instantly—cause trouble inevitably.

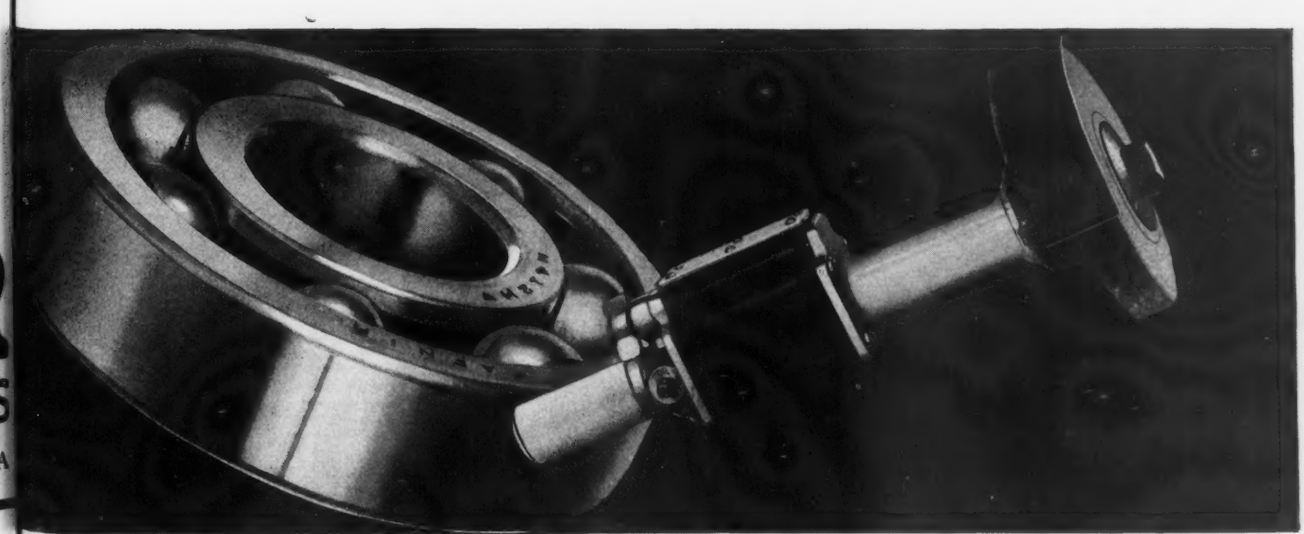
So only Fafnir Ball Bearings are used in the Rotor Air Tool Company's popular "High Production" Grinder. Fafnirs support the spindle and carry the full weight of the grinding wheel. They combine with the balanced rotor design to maintain perfect balance and prevent vibration, at every speed.

Fafnirs are built to bear the brunt of hard service indefinitely. They are made to ultra-precision standards . . . subjected to 45 different inspections to insure their accuracy and strength. Shocks and heavy loads are readily absorbed by the deep races and large balls, load-proofed with Fafnir molybdenum steel and hardened throughout for longest life.

Equip your machinery with Fafnir Ball Bearings. Among other things, you will find—as the president of the Rotor Air Tool Co. puts it—that "the use of Fafnirs makes it unnecessary to argue about the bearings."

THE FAFNIR BEARING CO.
NEW BRITAIN, CONN.

Newark Detroit Cleveland
Chicago Milwaukee Philadelphia



Introducing the

3rd

of a Wide Number of IMPROVEMENTS

The gears used in the "Libby" International Type "H" Turret Lathe are all alloy steel heat treated. The gears in the headstock have the Maag form tooth.

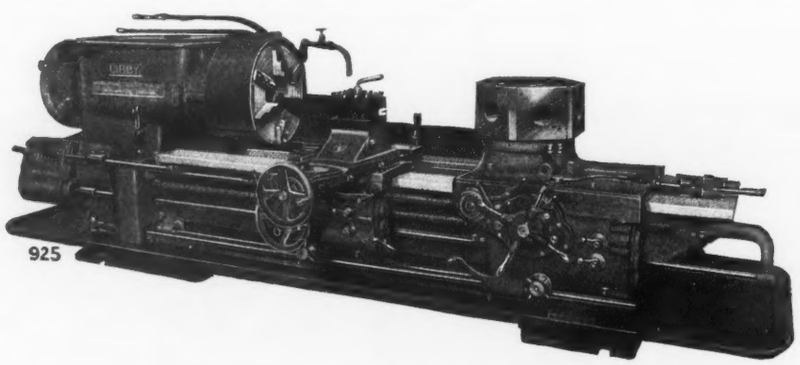
The important idea we are trying to convey in our advertising of the "Libby" International Type "H" Machine is that every feature emphasized is an *improvement*. In other words, when a change is made in the design of a "Libby" International Turret Lathe, it is not done to give us a new selling point, but to make the machine more efficient and more profitable for its users. There's a difference!

INTERNATIONAL MACHINE TOOL CO.

Indianapolis, Indiana, U. S. A.

DOMESTIC AGENTS: Blackman-Hill & Co., St. Louis, Mo.; Briggs-Weaver Machinery Co., Dallas, Texas; Brown & Zortman Mchry. Co., Pittsburgh, Pa.; E. L. Essley Mchry. Co., Chicago, Ill., Rockford, Ill., Rock Island, Ill., Milwaukee, Wis.; Harry M. Euler, Portland, Ore.; Louis G. Henes Mchry. Co., San Francisco, Calif., Los Angeles, Calif.; Wm. J. Leppert, Baltimore, Md.; Mine & Smelter Supply Co., El Paso, Texas, Denver, Colo.; Northern Machinery & Supply Co., Minneapolis, Minn.; Peden Iron & Steel Co., Houston, Texas; Rudel-Ryder Machinery Co., Toronto, Ont., Montreal, Que.; Seifreat-Elstad Machinery Co., Dayton, O., Cincinnati, O.; Smith-Courtney Co., Richmond, Va.; General Machinery Corporation, Boston, Mass.; Strong, Carlisle & Hammond Co., Cleveland, O., Toledo, O., Detroit, Mich; Crane-Scheifer-Owens, Inc., Syracuse, N. Y., Buffalo, N. Y., Rochester, N. Y.; Vandyck Churchill Co., New York, N. Y., Philadelphia, Pa., New Haven, Conn.; Vonnegut Machinery Co., Indianapolis, Ind.; Louis Walber, Seattle, Wash.

FOREIGN AGENTS: American Machinery Corporation, Madrid, Spain; Carl Schinz, Zurich, Switzerland; Coats Machine Tool Co., London, England; D. Drury Co., Inc., Johannesburg, South Africa; D. Drury Co., Ltd., Durban, South Africa; The George Hertting Agency, Prague, Czechoslovakia; Ing. Ercole Vaghi, Milan, Italy; Isbecque, Todd & Co., Brussels, Belgium; M. Koyeman, Inc., Dusseldorf, Germany; V. Lowener, Copenhagen, Denmark; Mitsui & Co., New York, N. Y.; Pedro Merlini, Argentina, South America; Victor G. Mendoza, Havana, Cuba.



There are twelve improvements in the "Libby" International Type "H" Machine. Send for the complete story.

"[INTERNATIONAL]" [TURRET] LIBBY LATHES

One Simple Test

would have saved 10 years of costly experimenting with reamers . . . Year after year—from one make of reamer to another—careful cost records—but never a competitive performance test—until the Cleveland "Cost-Per-Hole Test" was suggested.

Peerless High Speed Reamers were matched against reamers of a solid type which production officials of the plant had selected as the most economical. Performance of each on the same machine—on the same job, was carefully checked.

As Peerless reamers wore down they were expanded again and again to their exact original size. Each expansion gave a reaming capacity approximately equal to the entire production life of a solid reamer. When the final results were compared, Peerless reamers were found superior by 13,000 holes per reamer. On every reamer purchased for this job today, production officials are saving $23.04 by specifying "Peerless."

We believe that Peerless Reamers will cut reaming costs in your plant by at least 25%. Actually, numerous "Cost-Per-Hole Tests" have shown that Peerless Reamers cut costs on the average more than twice that amount If you would like to prove their economy, write for Digest No. 54. It will show you how to conduct the "Cost-Per-Hole Test" in determining the best reamer for your job.

The
CLEVELAND TWIST DRILL CO.
Cleveland, Ohio

We're interested. Please send a copy of Digest No. 54.

Name _____

Address _____

Town _____

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The CLEVELAND TWIST DRILL COMPANY CLEVELAND
NEW YORK-CHICAGO-LONDON
SAN FRANCISCO

TRADE MARK REG. U. S. PAT. OFF. AND FOREIGN COUNTRIES

Copyright, 1929, by The Cleveland Twist Drill Co.

G. & E. Manufacturing Shapers Ready to Set New Records

Four G. & E. Manufacturing Shapers lined up for shipment—ready to maintain the production records established by these new machines wherever used.

Each shaper is equipped with a universal table that may be swiveled to any angle.

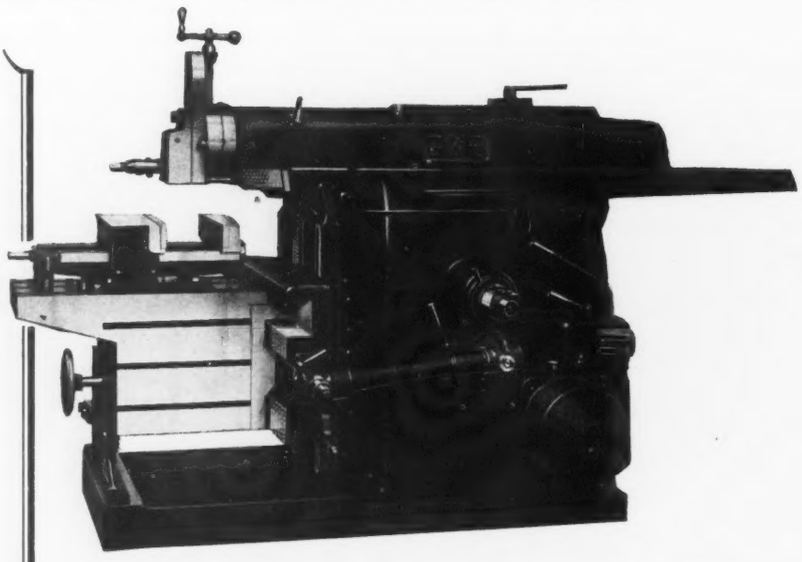
Provided with one solid working surface and one adjustable, tilting surface, this combination is especially valuable for tool room and die work when shaping flat and angular surfaces.

Wherever there is shaping work, G. & E. Manufacturing Shapers can do it with low tool cost and economical setup.

Ask us how they can do it for you.

Features

1. Power Rapid Traverse
2. Built-in Motor
3. Dual Control
4. Zee Type Work Slide
5. Circulatory Pressure Oiling
6. Double Crank Gear Transmission
7. Maximum Power Lever Ratio
8. Heat Treated Gears
9. Rigid Symmetrical Frame
10. Centralized Control
11. Single Cam Feed
12. Anti-Friction Bearings
13. Chilled 55° Vee Ram Guides
14. Rail Guide and Clamp
15. Table Support



GOULD & EBERHARDT G & E

NEWARK (Irvington), N. J., U. S. A.

Announcement

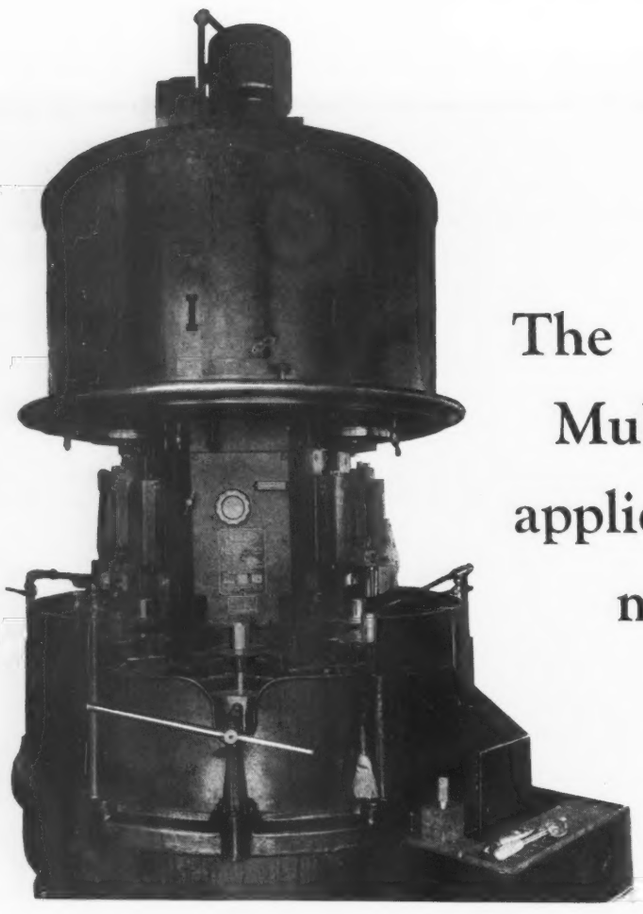
United States Letters Patent No. 1,621,223 covering Rotary Multiple Spindle Hobbing Machines was issued to The Lees-Bradner Company on March 15, 1927.

By recent final decision in contested proceedings in the United States Patent Office the priority rights of The Lees-Bradner Company in this invention have been definitely established.

We solicit your inquiries

THE LEES-BRADNER COMPANY
CLEVELAND, OHIO

It's A



The Mult-Au-Matic Idea applied to production means a new era!

Principles of Mult-Au-Matic design and performance, involving both the machine and the method, reveal new possibilities every day. New classes of work to which the machine can be applied, new sizes extending the range of the method, and a new scope of economical automatic production, particularly to smaller quantities and variety of work on the same machine.

The progressive manufacturer who first applies such ideas in his business reaps extra profits. If his competitor does it first he has to follow later just to maintain a fair profit margin.

The Mult-Au-Matic Method will contribute to your success in either case.

But do it first!

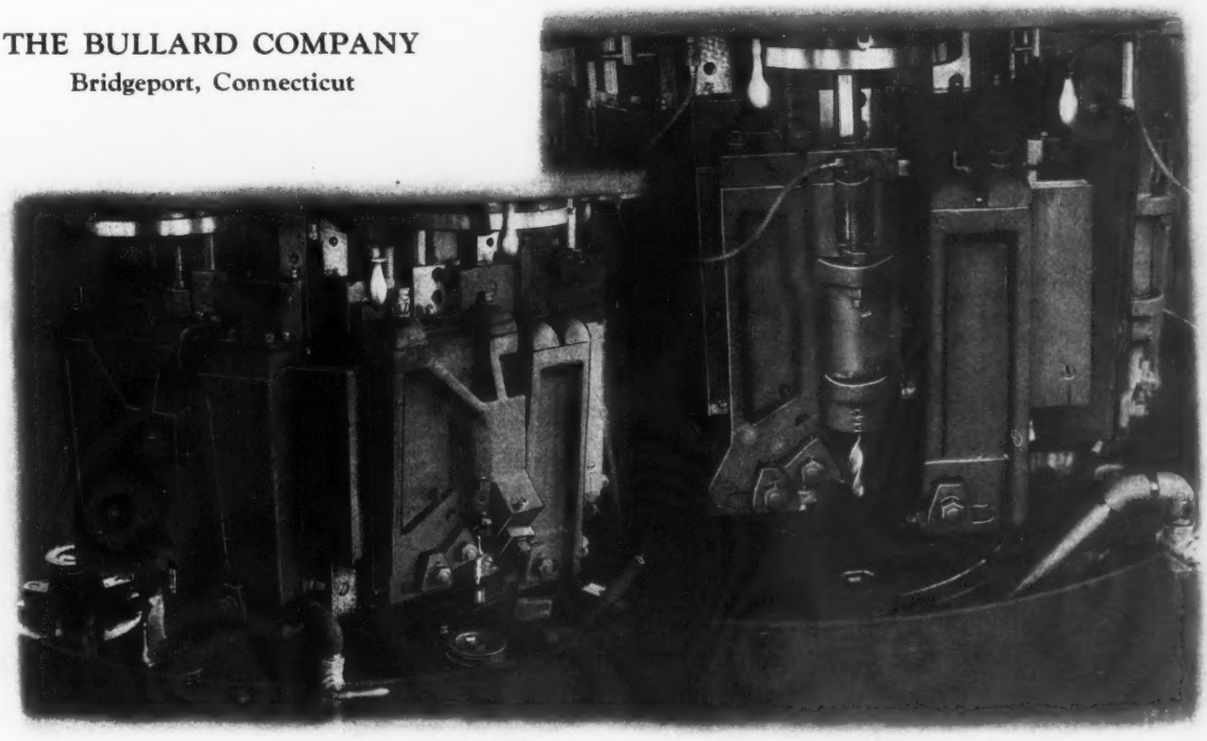
A Matter of Principle

Versatility in
Standard Mult-Au-Matics
meets the style or design change in Products

And the principle of standardized construction, versatile machinery that covers a range of possible operations, is important. Then a change in design of product does not throw your equipment out of use. The more it can do the more it will have to do, either in quantity or variety. That's another Mult-Au-Matic idea.

The savings in manufacturing costs will return your investment within a short period. That, too, is a matter of *principal.* Not how much but how soon!

THE BULLARD COMPANY
Bridgeport, Connecticut



5½ = 4

ONE of the industrial leaders of America recently made the statement "when industry is 100% 'Carboloy-ized' it will do in 4 days what it now takes 5½ days to accomplish".

He was conservative.

Many of the industrial giants and equally as many smaller companies are now completely tooling their plants with Carboloy (cemented tungsten carbide cutting tools).

These companies will have a material advantage over their competitors.

Consult the branch nearest you.

Look for the mark of Carboloy,—if the mark is not on the product it is not a Carboloy cemented tungsten carbide product.

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The Mark of CARBOLOY
TRADE MARK REG.

Speed Production with CARBOLOY

TRADE MARK REG.

JACOBS

Ball Bearing

Super Chucks

Improved Type

Plain Bearing Chuck

Keyless Type

Portomatic Chuck

Arbors for Jacobs Chucks

COUPON

JACOBS MFG. CO., Hartford, Conn.

Send at once your Catalog No. 26 to the following persons in our organization:

.....

.....

.....

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Signed

Spindle Specifications — Electric Tools, Pneumatic Tools, and much other Valuable Information.

MACHINERY
AUGUST 1929

UNION

Ample Chip Room

Strong Teeth Properly Spaced

We hear many nice things about our Tools—"Unusual Results," "Accuracy," "Long Life," etc., but—Our Tools should be superior.

Our long experience, competent engineers, a plant complete in every detail—that's the answer.

The cost of tools should be based on production.

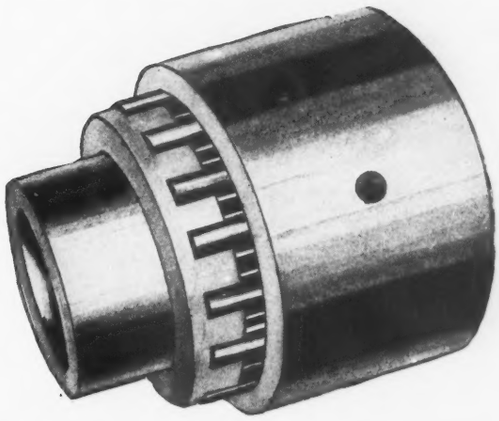
Our complete catalog sent on request.

UNION TWIST DRILL CO., Athol, Mass.

Twist Drills, Cutters, Hobs, Reamers, Taps, Dies, Screw Plates, etc.

62 Reade St., New York 121 Second St., San Francisco 11 So. Clinton St., Chicago

Mansfield, Mass. - Derby Line, Vt.— Rock Island, Quebec



Lower Power Costs . . . Lengthen Machine Life with Superior Bearings

We can show you, in black and white, just the kind of reductions in power costs, and the increased machine efficiency which Superior Ball and Roller Bearings will produce in your plant. Prominent manufacturers, aware of the important profit possibilities in good bearing equipment, have kept accurate tabs on their Superior installations. These figures are available to you — we'd like to have you see them.

Superior Ball and Roller Bearings are like your fine machines. Seldom, if ever, is their capacity reached and the reserve created provides unequaled efficiency, years of uninterrupted service and operating costs well below the usual. Notice the high degree of finish of Superior Bearings, an indication of the selected materials and careful workmanship employed — *defective bearings are out of the picture.* Made in standard sizes or to your specifications. If you have special bearing problems, mention them when you write for those installation figures.

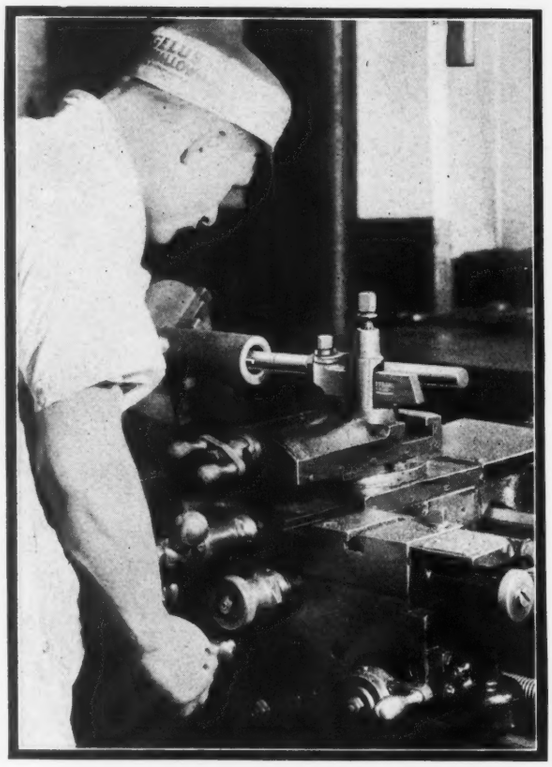
The Catalog is No. 11

The Ball & Roller Bearing Co.

Danbury, Conn., U. S. A.

SUPERIOR BALL AND ROLLER BEARINGS

ARMSTRONG TOOL HOLDERS are used in over 96% of the Machine Shops and Tool Rooms. (Selected for the Byrd Expedition to the South Pole—dependable, efficient).



We are using Armstrong Tool Holders on all of our machines.

—M. F. MOORE, Manager
Kewanee Boiler Corporation
Kewanee, Illinois

"We are using ARMSTRONG Tool Holders, and have since you introduced them, on all of our machines. They are very satisfactory and our Master Mechanic advises that he is using very few solid forged tools, thereby making a great saving in the cost of tools."

ARMSTRONG
Boring Tool

Equal in practical efficiency to a whole set of forged boring and inside thread tools.

It is true economy to use ARMSTRONG Tool Holders on *all* machines, for every operation on Lathe, Planer, Slotter and Shaper. The same basic principle—that of an inserted high speed steel cutter in a permanent shank or holder—carries thru the entire ARMSTRONG Tool Holder System. Regardless which of the over 100 sizes and shapes of holders is needed, regardless what the work to be done, an ARMSTRONG Tool Holder will save all forging, 70% of grinding and 90% of High Speed Steel.

ARMSTRONG BROS. TOOL CO.

"The Tool Holder People"

313 North Francisco Avenue, CHICAGO, U.S.A.

ARMSTRONG

TRADE MARK REG. IN U.S. PAT. OFFICE

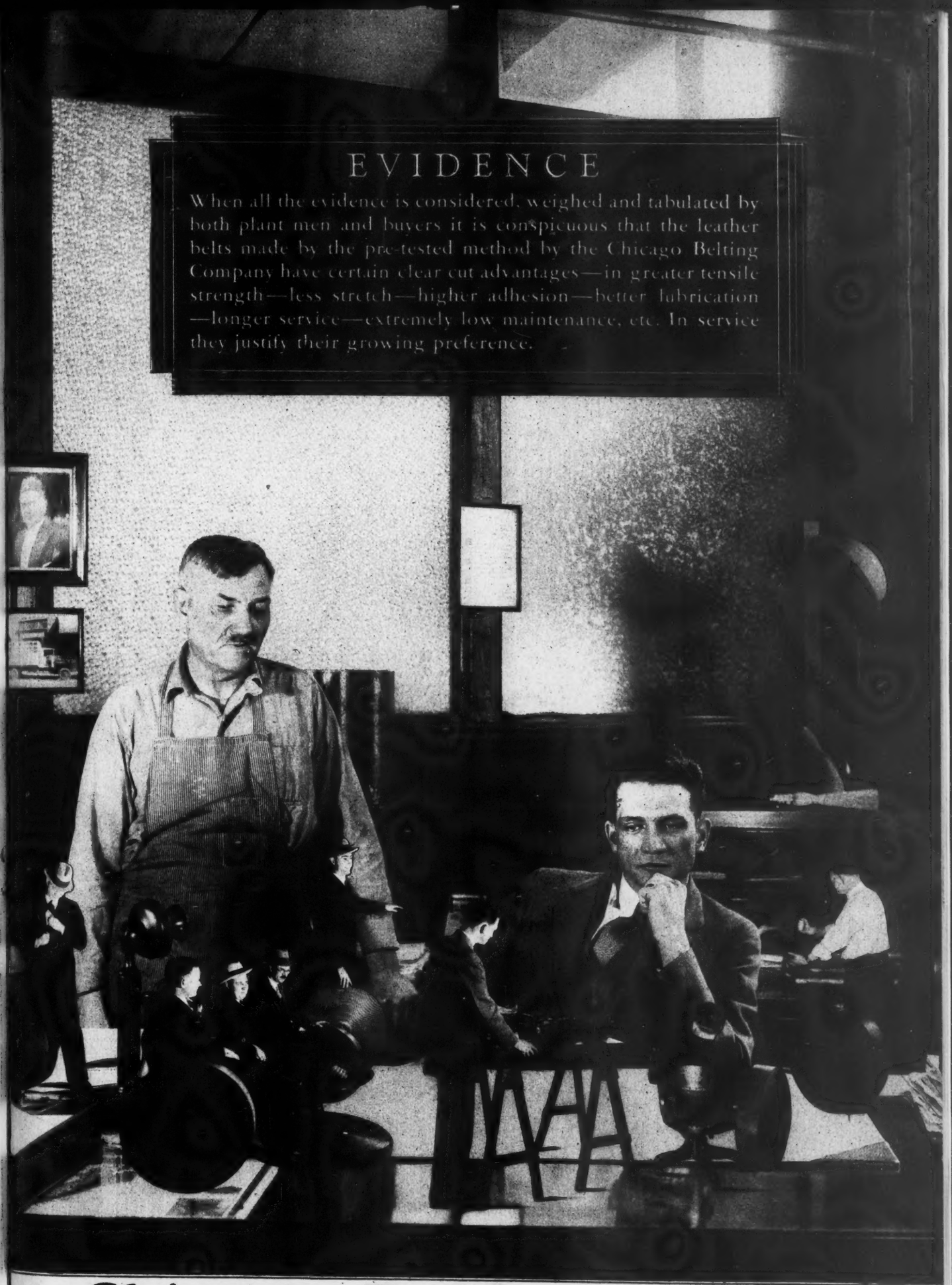
ARMSTRONG

Tool Holders
Lathe Dogs
"C" Clamps
Drop Forged Wrenches
Ratchet Drills
High Speed Cutter Bits

Write today for Catalog B-27

ARMSTRONG BROS.

Stocks and Dies
Chain Pipe Tongs
Pipe Wrenches
Pipe Cutters
Chain Vises
Hinged Vises


EVIDENCE
When all the evidence is considered, weighed and tabulated by both plant men and buyers it is conspicuous that the leather belts made by the pre-tested method by the Chicago Belting Company have certain clear cut advantages—in greater tensile strength—less stretch—higher adhesion—better lubrication—longer service—extremely low maintenance, etc. In service they justify their growing preference.

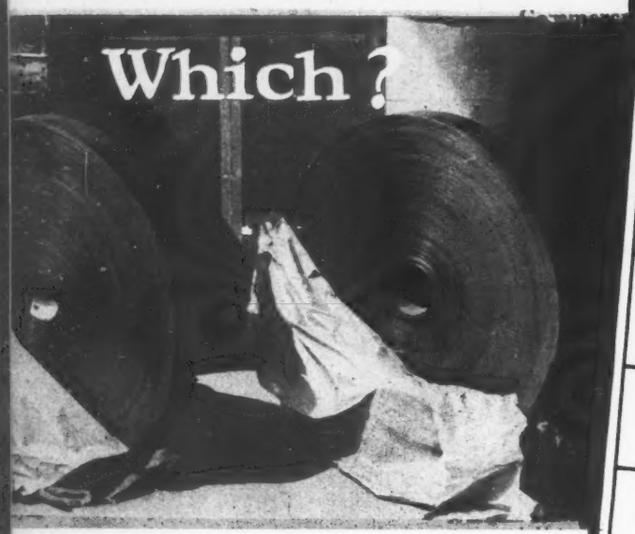
Chicago Belting Company

See next page

The Leather Belt With Group Drives Is the Standard of All Power Transmission

A leather belting score card

Put down on this score card the answers to these questions on ANY belting. Leather, or rubber or any other kind of belting. Then compare the answers. It is worth doing. It helps you to an appreciation of values.



Questions	Chicago Belting Co.	Other Belts
How long will the belts last?	Average service on normal drives over 10 years.	
How strong is the belt?	Averages higher tensile strength than any other oak leather belting.	
How much stretch has the belt?	Has less stretch than any other belting in the world.	
How does the belt grip the pulleys?	Averages higher adhesion to pulley than any other oak belts.	
What percentage of its weight is lubricating greases?	Between 11% and 12% only.	
Is the belt elastic?	All Chicago Belting belts guaranteed to have high elasticity.	
Will the belts handle overloads?	Overload capacity 100%.	
Can the belts be made endless?	Yes. Easily. Anywhere—in brief time.	
How strong are the endless joints?	Guaranteed to be practically as strong as the leather itself.	
Will the joints ever come apart?	Cemented parts guaranteed not to open up or come apart.	
How long has mnfr. been making belting?	Since 1889 — forty continuous years.	
Does the belt maker advocate card records of belt service?	We distribute card records free and urge that actual service be basis of purchase.	
Does manufacturer test your belts?	Every known physical and chemical test made daily in our plant.	
Does manufacturer distribute nationally?	Chicago Belting has 72 stocks for immediate delivery — all parts United States.	
Who uses their belts?	Largest manufacturers in almost *every* industry.	

The quality of the leather belts made by the pre-tested method by the Chicago Belting Company is such that—

—belt trouble can be entirely eliminated on any drive.

—belt replacements can be reduced 25% to 50%.

—your producing machines are kept running at full speed.

—your power factor increases.

Write for Chicago Belting leather belt standards and literature.

Chicago Belting Company

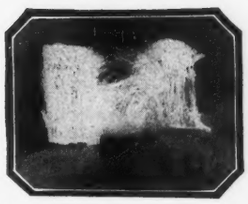
Chicago Belting Company

New York, Boston, Pittsburg, Cleveland, Milwaukee, Philadelphia — *Manufacturers of Leather Belting* — New Orleans, Los Angeles, San Francisco, Portland, Ore., Seattle, Wash., Atlanta

115-125 North Green Street, Chicago, U.S.A.

Chicago Belting Company

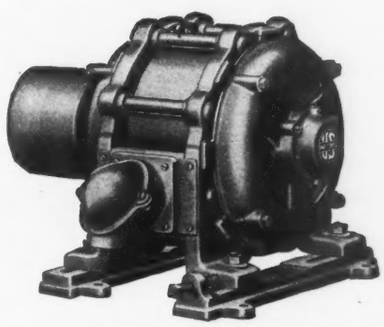
AMERICA'S MOST ECONOMICAL LEATHER BELTING



ASBESTOS IS A FIBROUS ROCK THAT HAS NOT CHANGED IN CHARACTER OR FORMATION FOR THOUSANDS OF YEARS. IT IS INCOMBUSTIBLE. THIS IS THE PROTECTING ELEMENT IN U.S. MOTORS.

Insulating U. S. MOTORS with ASBESTOS

>>>>>The only incombustible non-carbonizing fibrous winding material



ASBESTOS is built into U. S. MOTORS for protection of the electrical windings. The U. S. method of insulating the windings infinitely increases the life of the motor and minimizes danger of breakdown.

U. S. Asbestos insulation replaces carbonizing materials. Asbestos is the greatest of all pliable, heat-resisting materials because it cannot carbonize. Being soft and flexible, it is an insulation that can be folded and worked into the windings.

In addition to the use of Asbestos, U. S. engineers have developed a companion material,—Asbestosite—a heat-resisting compound, developed especially for impregnating the windings of U. S. MOTORS. It was perfected by intensive experimentation in quest for a non-combustible medium of insulation for individual wires. Each wire in the windings is separated from its neighbor by complete encasement in Asbestosite. All interstices between wires are displaced with the compound, application being accomplished by the U. S. patented method of coil separation, whereby an interrupted current is passed through the windings while the Asbestosite impregnates them.

Through baking and particular curing means the Asbestosite is hardened and forms a solid, intimately attached to and isolating each turn of the windings.

No insulation development in recent years can compare with the advanced principle of Asbestos Protection as incorporated in U. S. MOTORS. It is the greatest contributing factor to the sustained life that U. S. MOTORS are noted for.

While no motor may have a perpetual life,—the U. S. STATOR ranks with the ROTOR as practically indestructible. But Asbestos protection is only one of the exclusive U. S. MOTOR developments. Another feature is the U. S. AutoStart principle, which ushered in the automatic push-button era for large, squirrel-cage motors. Probably no development in the past twenty years was so far-reaching in simplifying motor operation.

Still another feature of outstanding importance is the U. S. Die-Cast Aluminum Rotor, which replaces multi-part assembly with 1-piece solid construction.

Other distinctive features mark U. S. MOTORS advanced design as well as uncommon production safeguards and facilities. These are graphically presented in the new pamphlets, entitled "ASBESTOS PROTECTION" and "U. S. AUTO-START MOTORS" which will be forwarded by any Distributing Office below.

¼ H. P. to 125 H. P. RATINGS

Horizontal and vertical motors of many types for modern industry.

U. S. ELECTRICAL MFG. CO.

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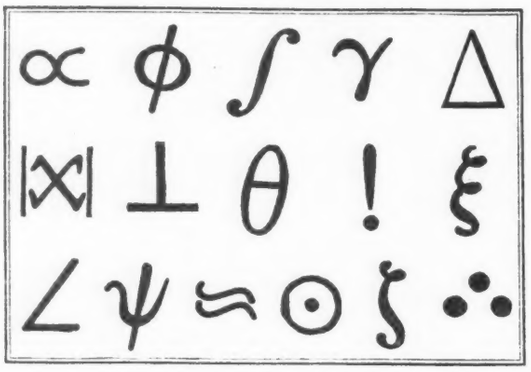
NEW YORK, N. Y.	CHICAGO, ILL.	SAN FRANCISCO, CAL.
71 Eighth Ave.	360 W. Superior St.	236 Fremont St.
ATLANTA, GA.	DETROIT, MICH.	PHILADELPHIA, PA.
676 Marietta St.	1446 Gratiot Ave.	617 Arch St.
BALTIMORE, MD.	EL PASO, TEXAS	PITTSBURGH, PA.
2 S. Frederick St.	208 San Francisco St.	Oliver Bldg.
BOSTON, MASS.	HONOLULU, T. H.	ST. LOUIS, MO.
137 Pearl St.	Fort & Beretania Sts.	731 S. Fourth St.
BUFFALO, N. Y.	HOUSTON, TEXAS	SAN ANTONIO, TEX.
41 Elm St.	4 Preston Ave.	405 Main Ave.
CINCINNATI, OHIO	INDIANAPOLIS, IND.	SPOKANE, WASH.
215 E. 3rd St.	113 N. Noble St.	S. 167 Wall St.
CLEVELAND, OHIO	KANSAS CITY, MO.	SYRACUSE, N. Y.
1549 Hamilton Av.	1117 Cherry St.	122 Dickerson St.
COLUMBUS, OHIO	LOUISVILLE, KY.	TOLEDO, OHIO
247 N. Front St.	113 W. Market St.	812 S. Lafayette St.
DALLAS, TEXAS	MEMPHIS, TENN.	TULSA, OKLAHOMA
309 N. Market St.	267 Adams Ave.	318 S. Boulder St.
DENVER, COLO.	NEW ORLEANS, LA.	VANCOUVER, B. C.
2900 Broadway	527 St. Joseph St.	1260 Hamilton Ave.

LOS ANGELES, CALIF., 200 E. Slauson Ave.

U.S. MOTORS

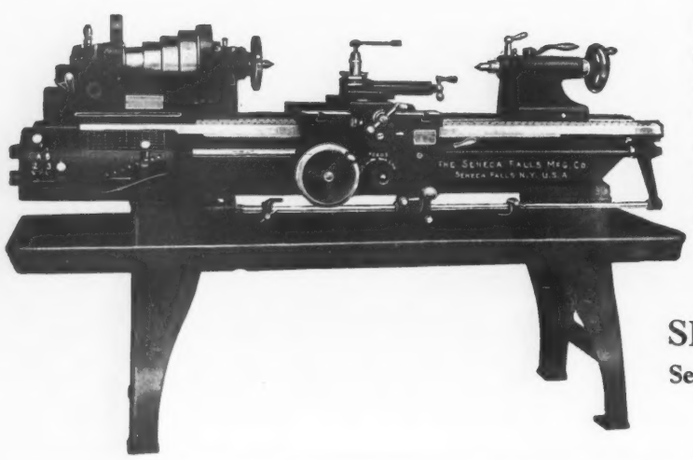
ASBESTOS PROTECTED



No! Not Arabic

The rather cryptic illustration above is used to convey the idea that things aren't always what they seem. Apparently an inscription on one of King Tut's memorandum pads, it is actually a few of the mathematical symbols which have just been approved by the American Engineering Standards Committee, according to POPULAR SCIENCE MONTHLY. Quite up-to-date, tho' apparently ancient.

STAR ENGINE LATHES



"Star" Engine Lathes can be misjudged almost as easily, too. There's nothing much about them to distinguish their capacities from those of other engine lathes, but in service they quickly prove different in many respects from their cousins of different makes. Accuracy that is "built-in," design that has been evolved to its present efficiency over a 50-year period of all-round shop use, greater operating convenience, more speed, and lower running costs are "Star" attributes that have induced standardization in any number of representative plants.

We have a lot of information we'd like to send you to prove there's as much difference in light turning equipment as in the big fellows.

SENECA FALLS MACHINE CO.

Seneca Falls :-: :-: **New York**

The So-swing People

What Plant can afford Chaos..

Thirteen Times the Manpower of Industry Hidden Away in Electric Motors

Electric motors in America's industries today provide working capacity equal to 250 million workmen. That is more than 13 times the actual number of men employed. How effectively this army of "unseen" workers is used to bring down costs is determined by the care with which Motor Control is selected.

13

SUPPOSE each workman in the factory did things his own way—each salesman made promises to suit himself — each stenographer chose her own typewriter — each new bookkeeper changed systems to his own liking. What chaos would result?

Only by standardization can order be maintained in your business—a truism that applies to Motor Control with equal force and with like savings.

Standardizing on the Cutler-Hammer Line of Motor Starters assures the same dependable protection for *every* electric motor in your plant regardless of size. This is essential—for *any* motor can hamper or demoralize production if it breaks down.

Standardization permits a smaller stock of Motor Starters—for all C-H Starters are adaptable to a wide range of motors. Your stock of replacement parts, too, can be held to minimum because C-H parts are interchangeable.

Time is also saved. No need for mastering a new wiring diagram when another starter is installed. Your electricians soon learn what to do and how to do it. Their work is speeded by the convenience of installing any C-H Motor Starter.

Many leading plants have secured these savings by standardizing on C-H Motor Control. Machine manufacturers incorporate it in all motor-driven machines they build to insure the service and steady production you expect. And motor builders standardize on C-H Control by recommending it for use in all the motors they sell.

CUTLER-HAMMER, Inc.
Pioneer Manufacturers of Electric Control Apparatus
1204 St. Paul Avenue
MILWAUKEE, WISCONSIN

CUTLER HAMMER

The Control Equipment Good Electric Motors Deserve

(8615)

Spur Gears

Insure smooth finish, due to our methods:

1.—Correct Material and Design

Nickel Chromium SAE 3250 electric furnace steel (in hardening this steel retains a high degree of toughness without distortion).

Our Spur Gears are designed to give an overlapping tooth action of sixty percent—i.e.—1.6 teeth are driving at all times.

This continuous tooth action, together with correct material and Timken spindle mounting, allowing metal to metal contact, eliminates chatter and gear tooth marks.

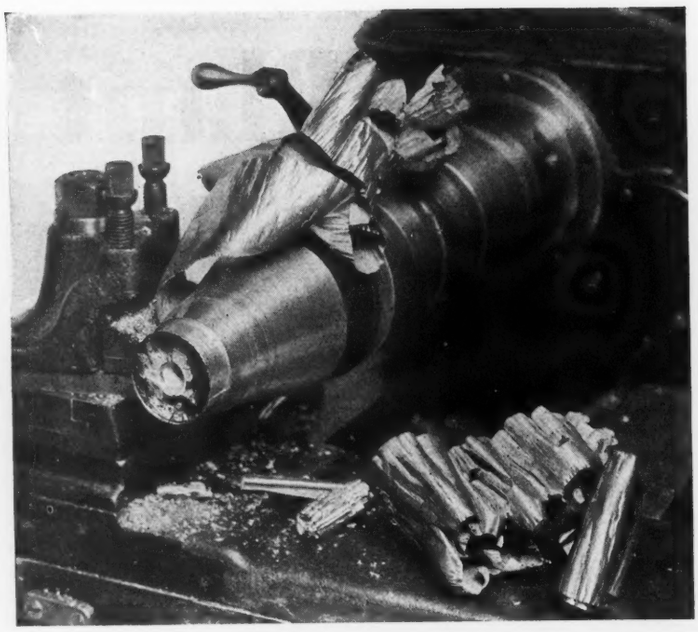
2.—Accurately Cut

Gear teeth are finished on latest type Fellows Gear Shapers.

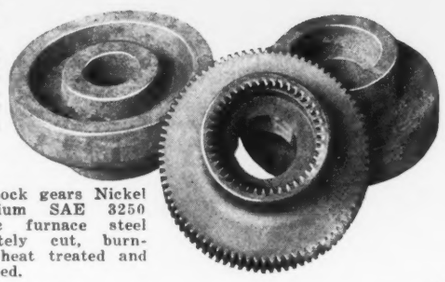
3.—Properly Finished

Gear teeth are burnished, giving smooth tooth surface, and hardened in electric furnaces with automatic control. Holes are ground on Heald Sizematic Internal Grinder from pitch diameter, insuring true running gears. Teeth of all sliding gears are rounded to permit smooth engagement.

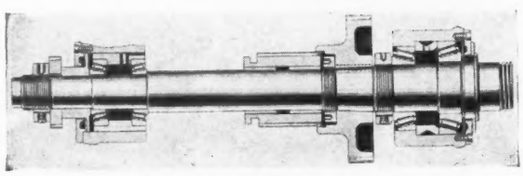
The above method compares in material and finish with the transmission gearing used in America's finest automobiles.



This unusual test was made **without tailstock.** Material is machinery steel, 20" long, 4½" diameter, threaded to spindle nose. Width of cut 3", feed .012" per revolution; speed 29 RPM. Not a sign of chatter (cut made from unretouched photo).



Headstock gears Nickel Chromium SAE 3250 electric furnace steel accurately cut, burnished heat treated and hardened.



Spindle Chrome Vanadium SAE 6140 heat treated alloy steel with 4-bearing Precision Timken Mounting.

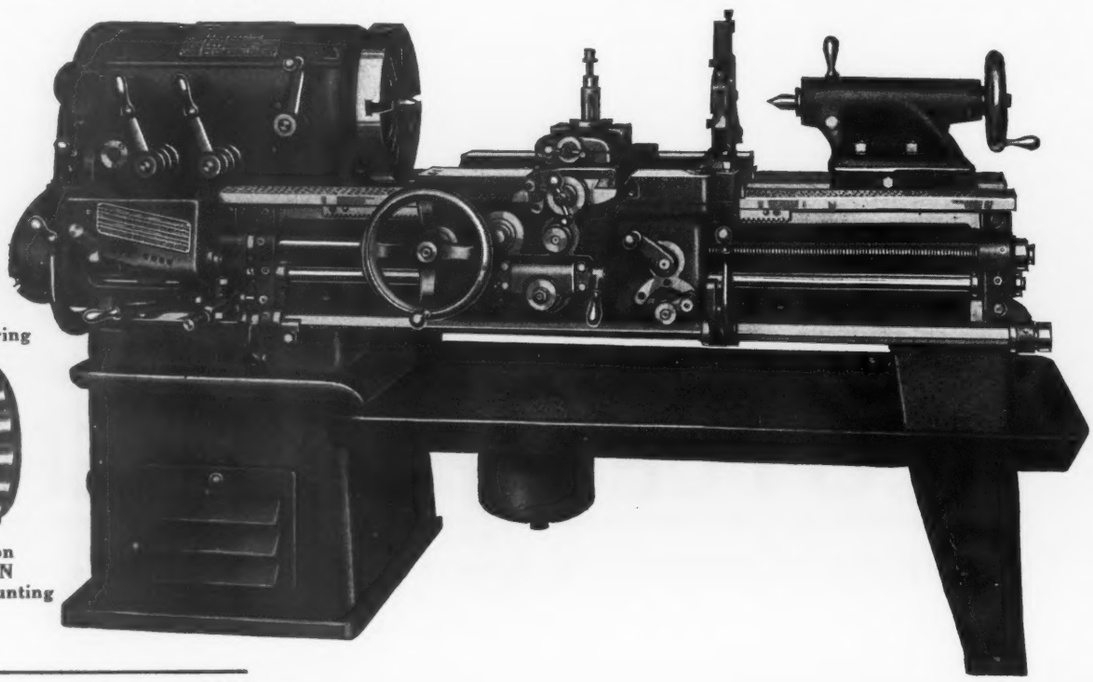
MACHINE TOOLS

REED-PRENTICE CORP.

WORCESTER MASS. U.S.A.

3-245 General Motors Bldg., Detroit, Michigan

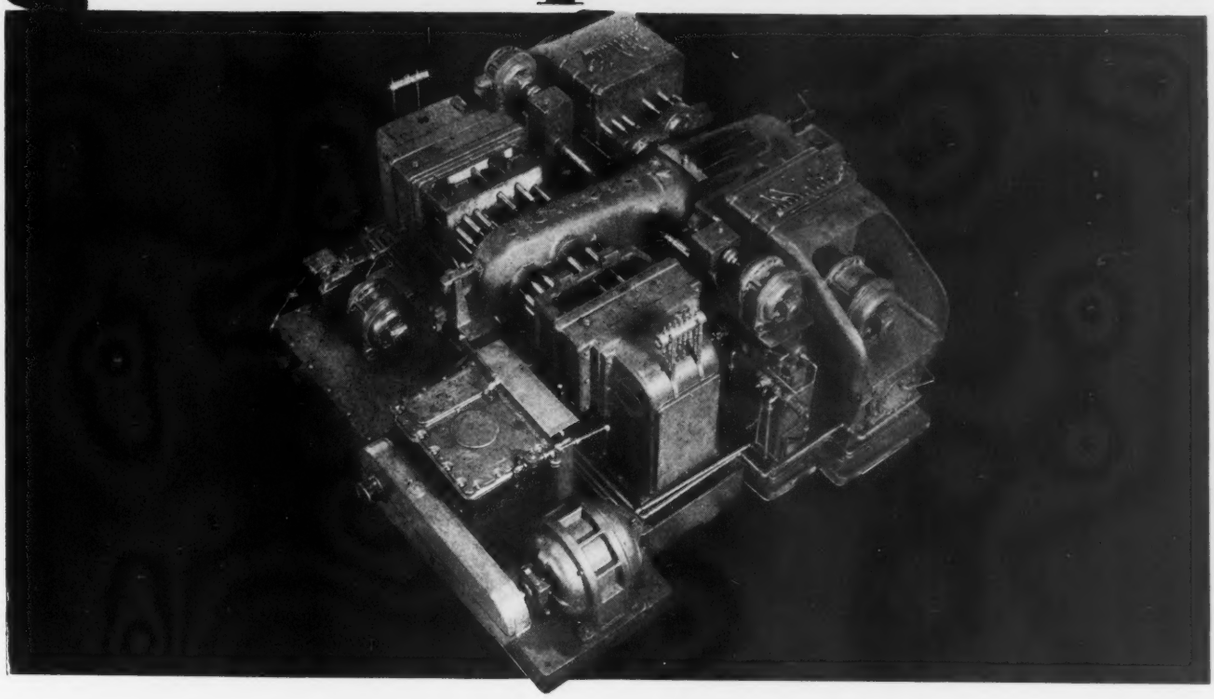
1508 Evening Post Bldg., 75 West St., New York City



Four Bearing

Precision TIMKEN Spindle Mounting

greater production



10 LARGE TRACTOR FRAMES DRILLED, FACED AND TAPPED EVERY HOUR

This machine is a combination Hydraulic Driller and Lead Screw Tapper being built up of Standard NATCO Hydraulic Drilling Units and NATCO Lead Screw Tapping Heads. The drilling units are equipped with the NATCO Hydro Uni-power system of hydraulic feed and are completely controlled by one air starting valve. The tapping heads are driven by one main reversing box which is driven by a 25 H.P. constant speed motor.

This machine, which is used in a large MODERN tractor plant, drills 26 holes, faces 2 holes and taps 26 holes in two sides of a large tractor frame.

The above is another example of MODERN equipment being used to lower drilling costs.

Why not let NATCO Engineers study your drilling and tapping problems?

THE NATIONAL AUTOMATIC TOOL CO.
RICHMOND, INDIANA, U. S. A.

Chicago Office:
1309 Engineering Building,
Wacker Drive at Wells St.

NATCO

Detroit Office:
4-238-9 General Motors Building

SOLVES YOUR "HOLE" PROBLEM

A brief description of "National 7716" High Speed Drills will be furnished upon request. Simply ask for folder No. 2.

Productive Twist Drills are made with wide flutes for easy egress of chips, well proportioned center web for requisite strength, and narrow lands to eliminate unnecessary friction and heating.

TWIST DRILLS
REAMERS · HOBS

NATIONAL

MILLING CUTTERS
SPECIAL TOOLS

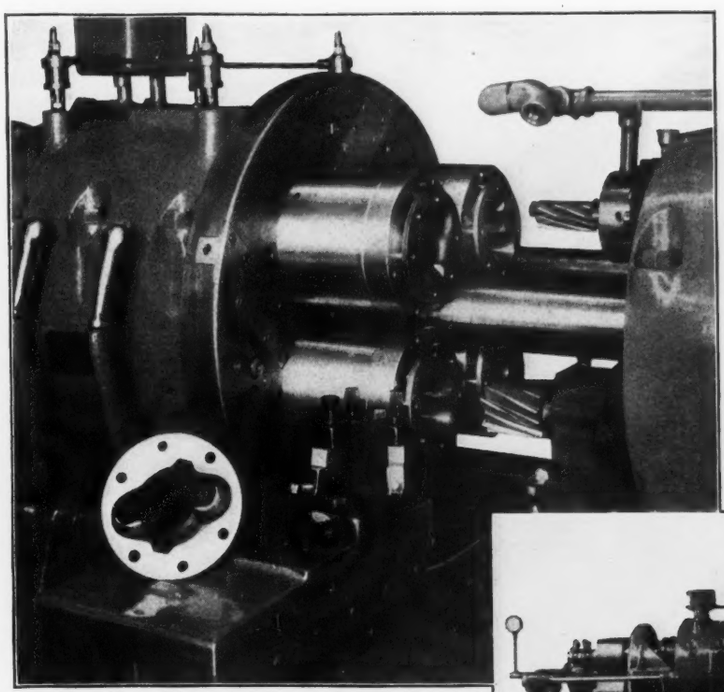
TWIST DRILL & TOOL COMPANY

DETROIT, U. S. A.

BRANCHES

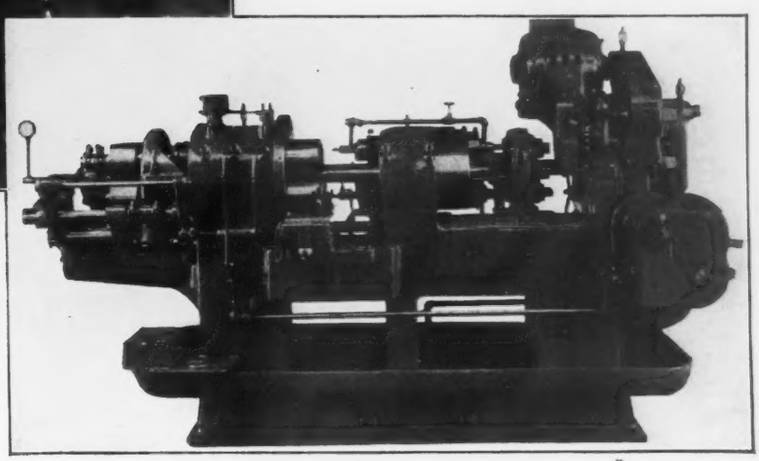
NEW YORK, N. Y. 274 Lafayette St. | PHILADELPHIA, PA. 43 North Sixth St. | CHICAGO, ILL. 1144 Washington Blvd. | CLEVELAND, O. 709 St. Clair Ave., N. W. | SYRACUSE, N. Y. 107 Clifford St. | BUFFALO, N. Y. 76 Pearl St. | INDIANAPOLIS, IND. 25 W. South St.

TAP AND DIE DIVISION, WINTER BROTHERS CO., WRENTHAM, MASS.



Off-Center Boring

a Feature of This Stamped Housing Job



A SEQUENCE of three boring operations, two of them off center, in a stamped steel housing for a universal drive shaft, are interesting features of a recent Cleveland Automatic Installation.

The machine is a specially adapted 4½" Model M, 4-Spindle Chucking Machine, the work being loaded by hand on the upper front position. Of the three holes to be bored, one is concentric with the flange and the other two, while in line, are approximately 1¼" inches off center.

After chucking, the first off-center hole is bored in the upper rear position and the second off-center hole bored in the lower rear position. In the lower front position, the center hole is bored, the outside diameter turned, the flange faced and both its corners beveled.

Except for chucking, the machine is full automatic. The housings are held in a special chucking fixture, operated by air. All tools cut simultaneously and adjustment is provided to accommodate flanges of different diameters and spread of holes.

There are perhaps, operations in your plant which can be simplified, speeded and costs reduced by specialized Cleveland equipment. Our engineering department will be glad to submit recommendations.

CLEVELAND AUTOMATICS

THE CLEVELAND AUTOMATIC MACHINE COMPANY

Cleveland, Ohio, U. S. A.

NEW YORK
95 Liberty Street

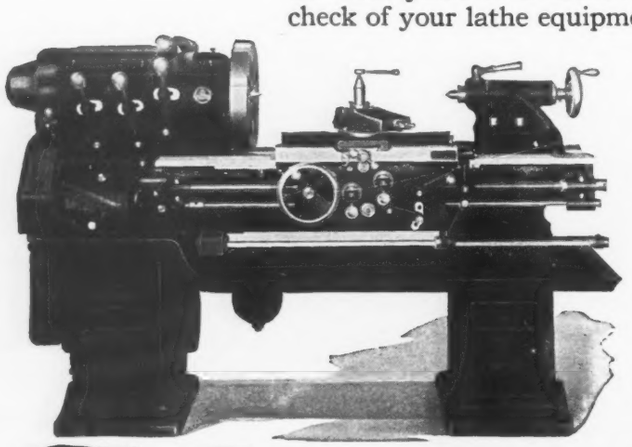
CHICAGO
565 W. Washington Boulevard

DETROIT
1217 Book Building

Are You Paying Tribute to Obsolescence?

ARE slow, old-fashioned, obsolete lathes slowing up your production and increasing your costs? Are you paying, as tribute to obsolescence, earnings that stockholders would prefer to receive as dividends?

The last years of a lathe's life are the most costly. Make a careful check of your lathe equipment and see just what obsolete design, worn gears, ordinary bearings, inaccurate work, light cuts and slow speeds are penalizing you in the way of limited production and increased cost of doing business.



Without obligation, Monarch engineers will be glad to check up on your lathe department. They will present reasons why Monarch Helical-geared Timkenized Lathes (that handle the new cutting tools to best advantage) can turn obsolescence costs into a profit.

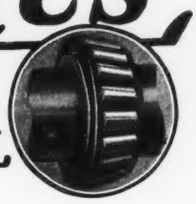
Write for new bulletin "Additional Reasons Why Monarch Lathes Should Be Your Choice."

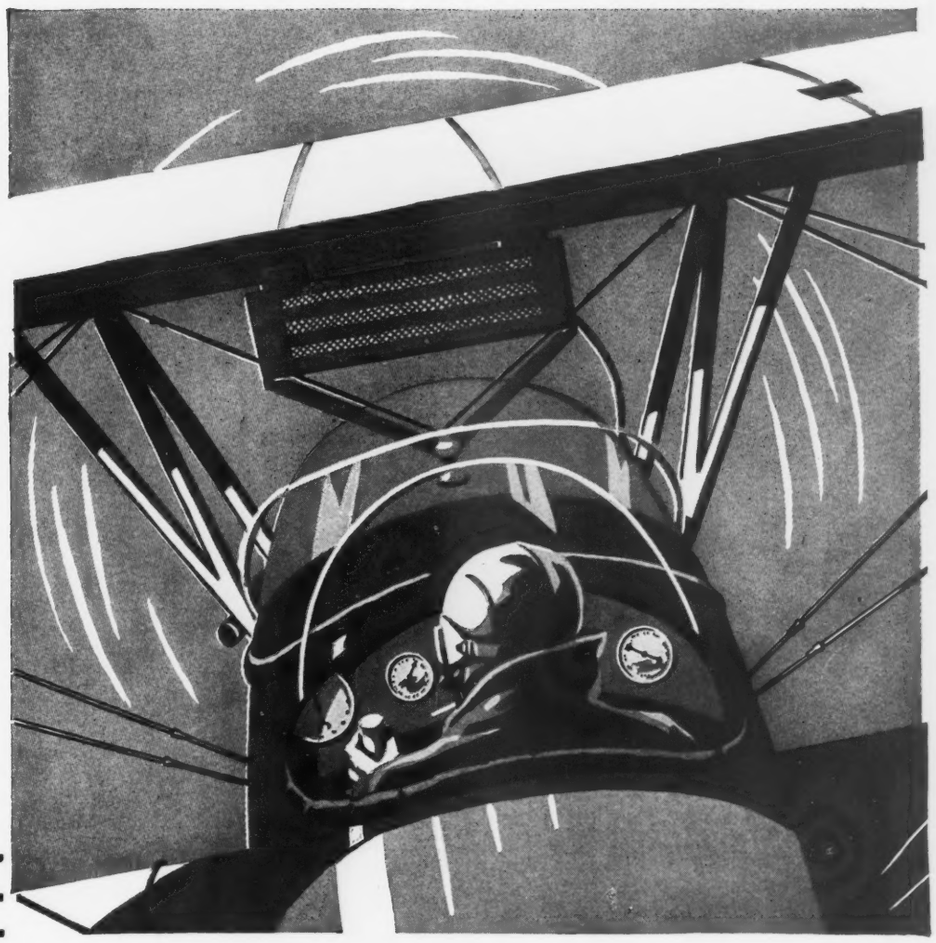
THE MONARCH MACHINE TOOL CO.
SIDNEY, OHIO, U. S. A.
New York Sales Office: 857 Graybar Bldg.

Monarch lathes

Helical Gears - Timken Bearings

SMOOTHER..QUIETER..MORE POWERFUL





WHERE SERVICE MUST NOT FAIL

Slender wires, wing struts, and delicate instruments separate life and death high up in the air. And plating—often less than a thousandth of an inch—is the faithful guardian that prevents wear and corrosion in our newest transportation industry.

The new plating requirements of aviation have been met by Hanson-Munning products and Hanson-Munning engineers. Cadmium, Chromium, Nickel and Zinc have found their place—in quantity production and with mass production costs.

Hanson-Munning Engineers have worked with the pioneers in plating departments in this and many other industries. When you have a product that must not fail, all the practical knowledge garnered by Hanson-Munning Engineers through the years is at your command.

HANSON-MUNNING PRODUCTS

Polishing machines, Lathes, Plating Equipment, Generators, Barrels, Tanks, Wheels, Abrasives, Buffs, Brushes, Compositions, Cleaners, Anodes and Salts

Leading manufacturers of polishing and plating equipment and supplies

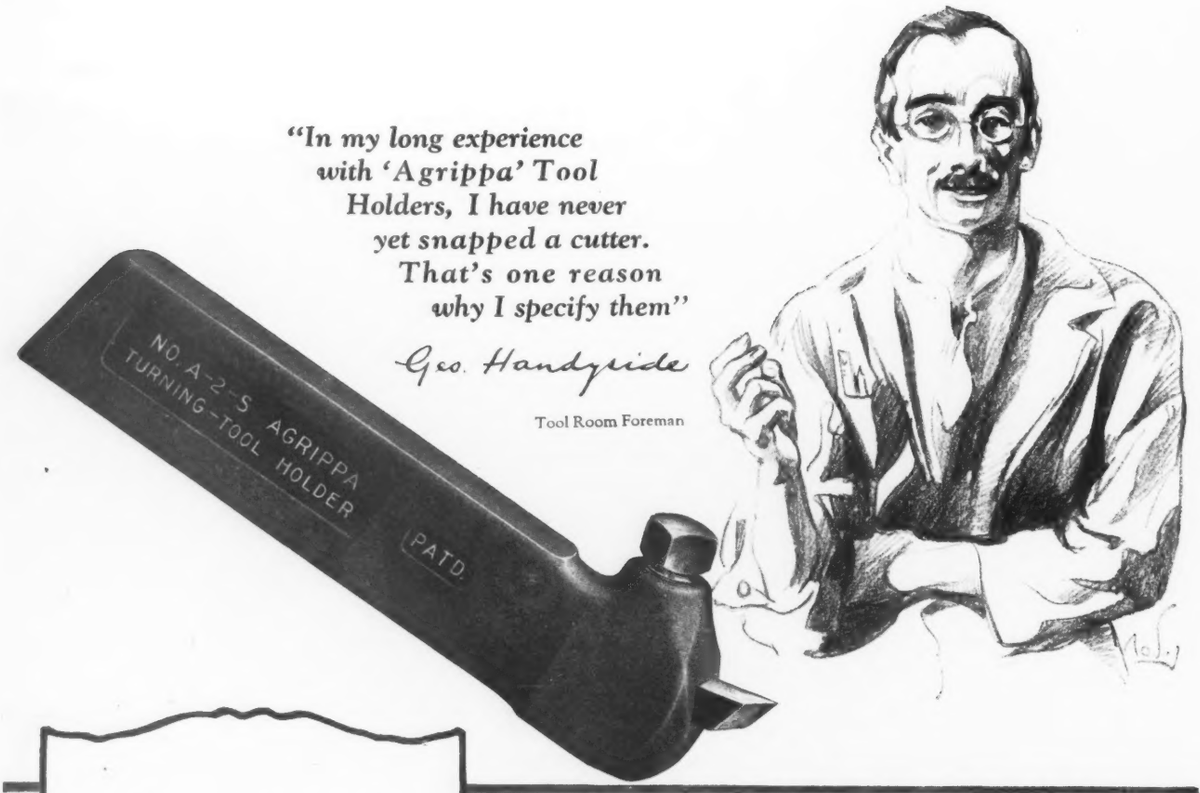
Hanson-Van Winkle-Munning Co., Matawan, N. J., and Chicago

2983

"In my long experience with 'Agrippa' Tool Holders, I have never yet snapped a cutter. That's one reason why I specify them"

Geo. Handyside

Tool Room Foreman



"never snapped a CUTTER"

A tool holder, to be efficient, must hold its cutter rigidly: to be economical, it must continue to do so after long, hard service.

Users swear by "Agrippa" Tool holders. In the Turning Tool, for instance, you will find that thru accurate broaching of the cutter hole and thorough hardening of the entire holder, Williams have eliminated recessed and marred cutter seats—the commonest cause of cutter breakage and general inefficiency.

Let us send literature on the complete line.

J. H. WILLIAMS & CO.

"The Drop-Forging People"

New York BUFFALO Chicago

Dependable Forgings

Williams' Superior Drop-Forgings come to you with our unqualified guarantee. Entirely dependable, they will meet your specifications to the last jot and tittle.

We operate our own chemical and physical laboratories and are fully equipped with modern facilities for all forms of heat-treating. All furnaces, electric or oil-fired, pyrometer controlled.

Let us quote you on accurate, dependable, clean, sand blasted forgings — guaranteed.

WILLIAMS

SUPERIOR DROP-FORGED TOOLS

"AGRIPPA" TOOL HOLDERS

"THE HOLDERS THAT HOLD"

"VULCAN"
Heavy Service
Safety
Lathe Dog
3 Sizes
4 to 6 in.

"VULCAN"
Safety
Lathe Dog
13 Sizes
⅜ to 5 in.

"VULCAN"
Heavy Service
Lathe Dog with
Square Head
Screws
3 Sizes
4 to 6 in.

"VULCAN"
Lathe Dog with
Square Head
Screw
13 Sizes
⅜ to 5 in.

unyielding STRENGTH

Williams' "Vulcan" Dogs are *drop-forged* from tough carbon steel—the screws are of special steel, hardened and tempered. Their dependable, unyielding strength assures freedom from expensive break-downs. Use "Vulcan" Dogs for better balance and accurate work—for improved quality and greater volume in production.

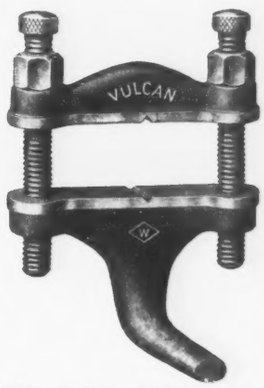
There's a size and style to meet practically every requirement.

Send for "Vulcan" Lathe Dog facts *today*.

J. H. WILLIAMS & CO.
"The Drop-Forging People"
New York BUFFALO Chicago

WILLIAMS
SUPERIOR DROP-FORGED TOOLS
"VULCAN"
LATHE DOGS

"VULCAN" Dogs



"Vulcan" Clamp Lathe Dog, drop-forged from special steel and heat-treated for extra stiffness. The adjusting nuts provide for minimum projection of screws. 4 sizes, 1⅝ to 3¼ in.

"Vulcan" Milling Machine Dog, with flat tail for taper work carried on centers. They also serve as a heavy pattern lathe dog. 7 sizes, ½ to 2 in.

With Seamless You Can Do Anything that is Practical With Bar Steel

and you save the cost of the hole

AMONG the various shapes, sizes and wall-thicknesses of NATIONAL-SHELBY Seamless Steel Tubing, you can probably find a material of just the right dimensions, grade of steel and anneal for your present or prospective requirements. With tubing you start with the hole already bored and also with the assurance of uniform chemical and physical properties in the finished part. You can do anything with tubing that is practical with bar steel and by using seamless tubing, machine work is reduced, tools and labor are saved and exceptional uniformity obtained in the finished product.

We will be glad to send a copy of our handbook—"Seamless Tube Standards"—to anyone whose letterhead or position would indicate a legitimate use for it.

"NATIONAL SHELBY"
SEAMLESS STEEL TUBING

NATIONAL TUBE COMPANY - Pittsburgh, Pa.

Subsidiary of United States Steel Corporation

EVERYTHING that industry makes or uses must be moved!

Why, then, depend upon the slow, plodding pace of this Volga Boatman? Why, in this Age of Speed, gear production to the inefficiency of obsolete handling methods?

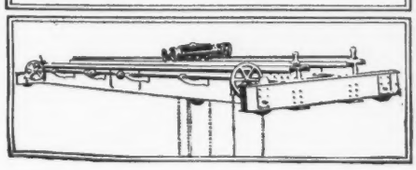
Production can move only as fast as its materials are handled. Machines and methods have been systematized to a fine degree; raw materials are purchased with scrutinizing care—yet in countless instances antiquated moving practices still swell the burden of manufacturing costs.

Chisholm-Moore has brought to many industries a practical and proven remedy for these ills. Without doubt, C-M equipment can reduce your handling costs.

A C-M engineer is at your service to analyze your particular problem. The benefits of his broad experience are yours without cost or obligation. Write us for information and descriptive literature on the C-M line.

* * *

Chisholm-Moore manufacture a complete line of overhead material handling equipment including chain hoists, electric hoists, travelling cranes, trolleys and the Morgan Cupola Charger. Special bulletins are available on any type of equipment.



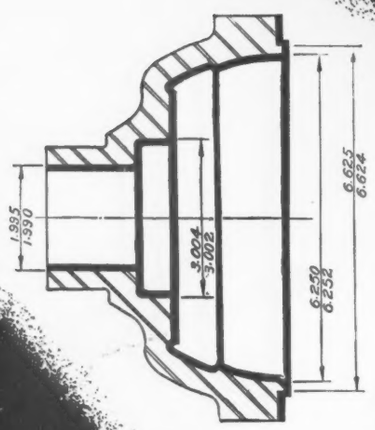
Chisholm-Moore Hoist Corp.
(Division of Columbus-McKinnon Chain Co.)
5038 Fremont Ave. Tonawanda, N. Y.
In Canada—St. Catharines, Ont.

CHISHOLM-MOORE
CHAIN HOISTS — CRANES, TROLLEYS, CUPOLA CHARGERS — ELECTRIC HOISTS

NEW YORK PHILADELPHIA CLEVELAND CHICAGO PITTSBURGH

Better than 18

DROP FORGED STEEL DIFFERENTIAL CASE HALVES per HOUR

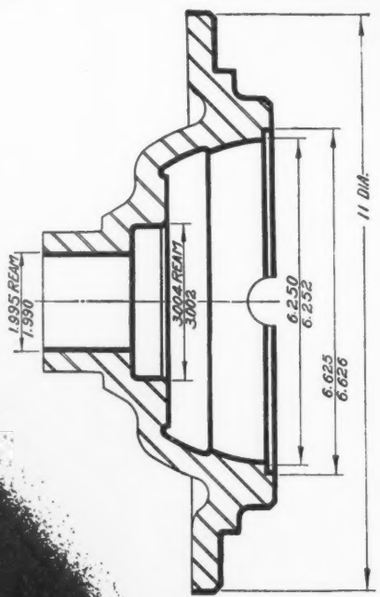


11 minutes Floor to Floor

P&J

produced by

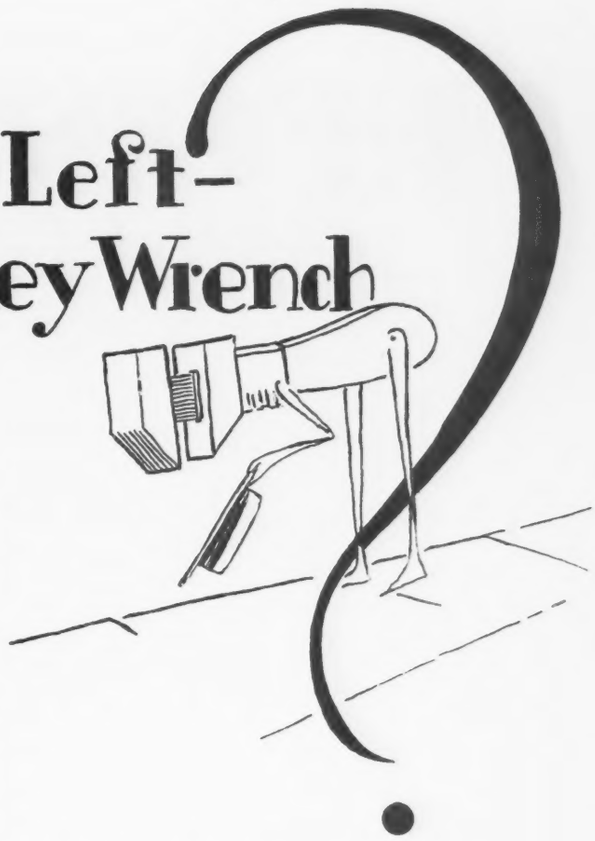
ONE OPERATOR
running a battery of
***FOUR* POTTER & JOHNSTON**
5-D POWER-FLEX AUTOMATICS



13 minutes Floor to Floor

Potter & Johnston Machine Co.
Pawtucket, Rhode Island, U. S. A.

Ever Meet the Left-Handed Monkey Wrench



If all the apprentice boys that have searched for this legendary bit of shop equipment were placed end to end, it would give a rough idea of how far ahead of ordinary lathe equipment is the Lo-swing And if you yourself set out to find it, your chances of success would just about equal the likelihood of duplicating Lo-swing performance with other lathe equipment.

Here are some facts on Lo-swing turning that are bound to interest you:

A Lo-swing is equipped with multiple cutting tools. Thus a job that requires three and four tool travels with ordinary equipment, on a Lo-swing is a *one-operation* job.

One Lo-swing can very often handle the work of a battery of single tool equipment. Think of the savings in labor, power, floor space and depreciation this could effect in your plant.

A Lo-swing takes no longer to set up, reduces calipering and measuring, and does not require a skilled operator.

We have statistics showing consistent returns of from 62% to 150% on Lo-swing installations—others showing Lo-swing making good returns on small-lot precision turning.

Get in touch with us for this information *complete!*

SENECA FALLS MACHINE COMPANY

SENECA FALLS *The Lo-swing People* **NEW YORK**

District Sales Manager for Michigan, Ohio, Wisconsin, Illinois and Indiana: W. H. Nettle, 236 Richton Ave., Highland Park, Detroit, Mich.
Pacific Coast Representative: Louis G. Henes, San Francisco and Los Angeles.
European Office: 42 Rue le Peletier, Paris, 9e, France, in charge of George E. Fogarty, European Sales Manager.

The Lo-swing Lathe

PRECISION

Its meaning and its commercial value

PRECISION, as commonly used, is a term defining extreme refinement of dimension and finish. But as describing an outstanding quality of *NORMA-HOFFMANN Precision Bearings*, the word has a far more comprehensive meaning.

To Norma-Hoffmann engineers and production men, *Precision* means the ultimate in dimensional refinement. Above and beyond this, however, it means bearing design worthy of expression in a finished product of this extreme refinement—selected materials well deserving of special treatments and of highly refined machining processes—standards of production which permit no deviation from absolute uniformity, regardless of quantity.

***Precision*, as thus described, is the foundation quality upon which the Norma-Hoffmann reputation rests, upon which its business has been built, and upon which it must continue to grow.**

But what does all this mean to the buyer and user of *NORMA-HOFFMANN Precision Ball and Roller Bearings?* What, in other words, is the commercial value of *Precision?*

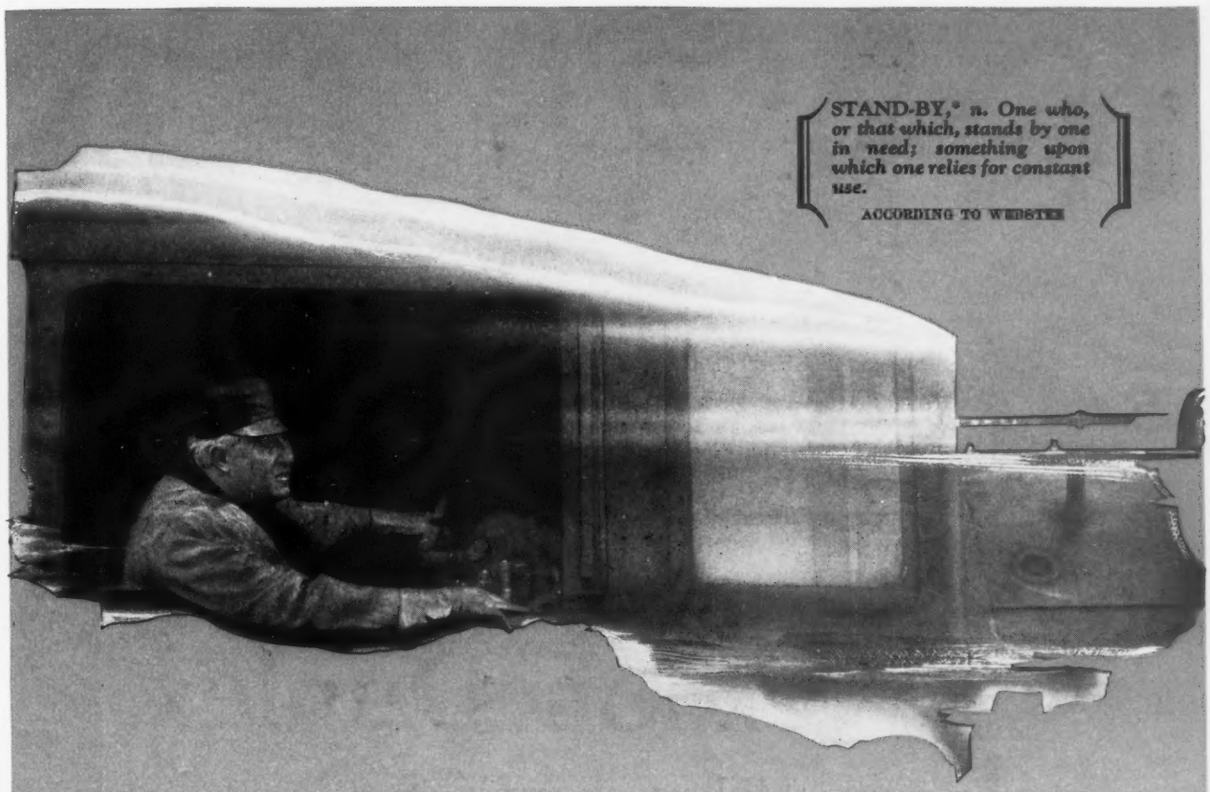
Briefly stated, *Precision* stands for that combination of qualities which manifests itself in higher anti-friction efficiency, longer life, greater speedability, better performance, lower costs for replacements, increased production. These are the distinct and concrete advantages which accrue to the user of *NORMA-HOFFMANN Precision Bearings*.

Obviously, *Precision* is costly to produce and to maintain. But it has been the uniform experience of those who have availed themselves of its advantages, that its price is repaid a hundred fold in the lower after-costs which inevitably follow.

The long varied experience of Norma-Hoffmann engineers is offered without obligation to machine users and builders facing bearing problems.

NORMA HOFFMANN PRECISION BEARINGS

NORMA-HOFFMANN BEARINGS CORPORATION
Stamford, Conn., U. S. A.


"STAND-BY," n. One who, or that which, stands by one in need; something upon which one relies for constant use.
ACCORDING TO WEBSTER

WHEN we crawl into "Lower 6" for the night, we hardly expect our sleep to be as restful as a night's sleep at home. Yet, as the train roars into the darkness, we give practically no thought to our safety, because we feel as secure in the Pullman as we do in our own bed. With unquestioning faith, we entrust our lives to the Locomotive Engineer—one of the good old stand-bys of the transportation world.

The field of pyrometry and electric heat, similarly, has that same good faith in Chromel—for its thermocouples and heating-elements. They, too, look on Chromel as a good old *stand-by. Because, for almost 25 years, they have found Chromel faithful to the tasks that are given it to do.

Chromel provides industry with its best base metal thermocouple—one that holds its accuracy through many months of hard service at heat-treating temperatures. A thermocouple that has no immersion-error; a couple that the user himself can make (if he so desires) because it does not have to be calibrated. For these reasons, industry's standard thermocouples are made of Chromel.

Chromel gave the electric heating industry its first nickel-chromium heating-element—the alloy that made electric heat practical for home and factory, because of its durability.

It will pay you to have all your pyrometers calibrated to fit Chromel couples; it will also pay you to specify Chromel heating-elements for your electric furnaces. If you want technical data, ask for Catalog F.M.

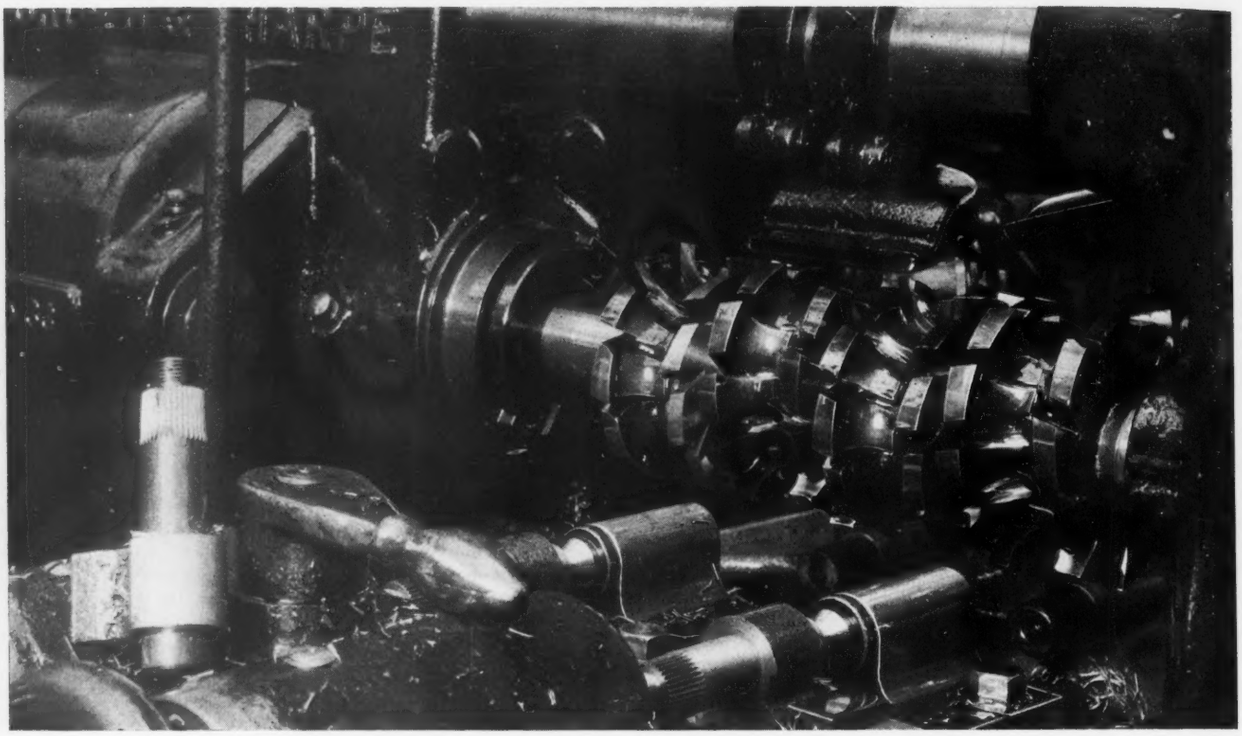
THE · WIRE · THAT · MADE · ELECTRIC · HEAT · POSSIBLE
Chromel
RESISTANCE WIRE

HOSKINS MANUFACTURING COMPANY
4439 Lawton Ave., DETROIT, MICH.
BOSTON NEW YORK CLEVELAND CHICAGO SAN FRANCISCO
Canadian Rep.: Hiram Walker & Sons Metal Products, Ltd., Walkerville, Ont.

Hoskins Chromel

THERMO-COUPLES AND RESISTANCE WIRE

CUTTERS *that keep pace with*



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AUTOMATIC PRODUCTION

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Brown & Sharpe Cutters are reducing the cutter costs of manufacturers the world over . . . you should secure the savings they can give you on all your cutter jobs.

The Cost of

Time Lost Removing Cutters
Plus Time Lost Replacing Cutters
Plus Lost Production
Plus Sharpening Cutters
Plus Original Purchase

Equals
Real Cost of Cutters

What is the Real Cost of Your Cutters?

BROWN & SHARPE

BROWN & SHARPE MFG. CO. PROVIDENCE, R. I., U. S. A.

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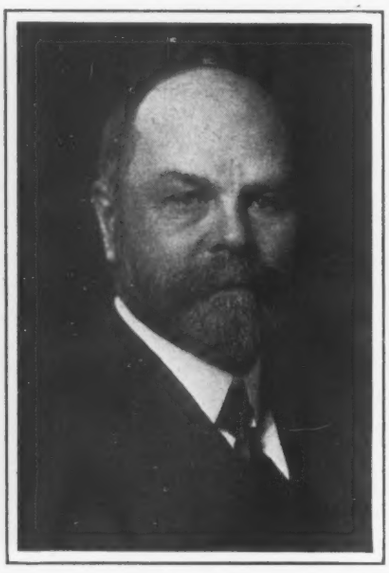

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In general appearance, the machine on which this grinding head is used resembles a small boring mill. The gear to be ground is mounted on the table of the machine, which is provided with an indexing mechanism and a slight lateral movement to apply the cut. The grinding wheel is carried in a spindle head that is moved up and down by means of a hand-wheel during the actual grinding.

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* * *

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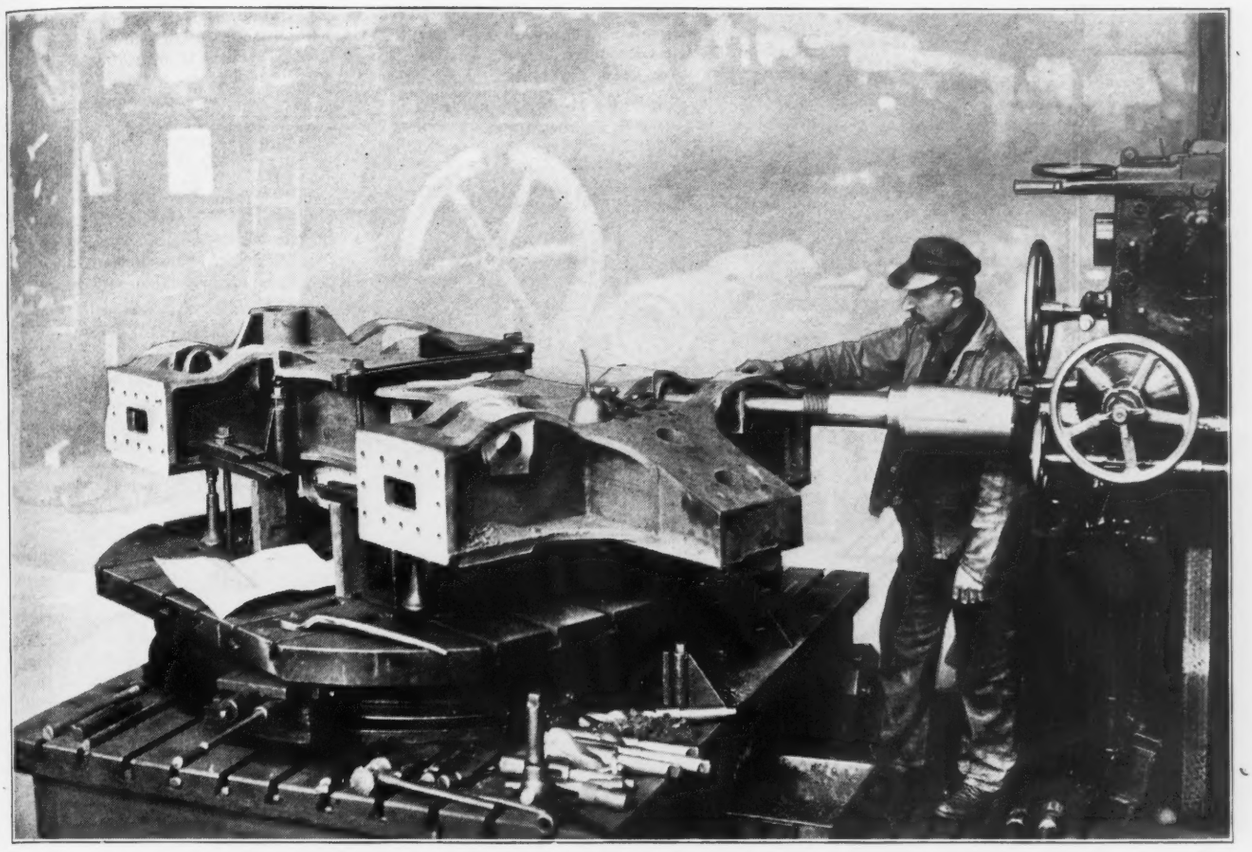


Drilling and tapping a cast iron Base Plate with a Horizontal Drilling and Boring Machine. The entire job—totaling 118 operations—handled with the one set-up.

Save Time and Labor — Handle the Entire Job from the One Set-Up

One simple set-up—then uninterrupted operation. Drill the entire job—four sides—from the one setting, on a simple rotary table.—Or drill five sides on ordinary work with a universal tilting and revolving table.

The set-up job is easier too. The worktable is at the side of the drill with no overhanging parts to interfere. Drilling, too, is faster and cleaner. Drilling pressure is against a heavy vertical column. The chips fall away from the hole, keeping the drill clean.

The Horizontal Drill simplifies the handling of difficult pieces. It gives you a wider range of operation and greater ease in handling the general run of work. It will show a big saving in floor to floor time.

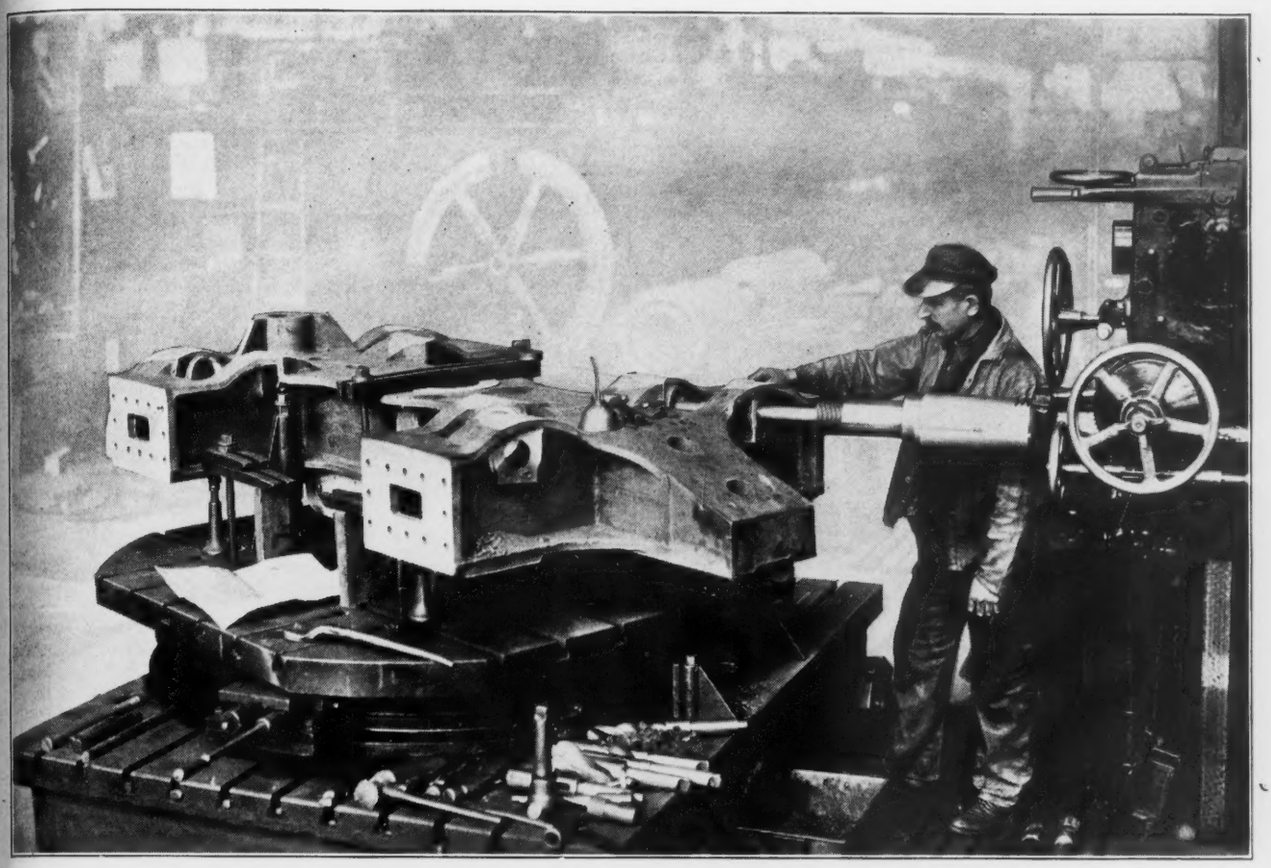
Write for complete information, specifications, and prices. Ask for Bulletin A-4051.

JOSEPH T. RYERSON & SON INC.
ESTABLISHED 1842

Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Pittsburgh, Philadelphia, Boston, Jersey City, New York, Richmond, Houston, Tulsa, Rockford, Kansas City, Los Angeles, San Francisco, Denver, Minneapolis, Duluth.

RYERSON

MACHINERY-SERVICE



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RYERSON

MACHINERY-SERVICE

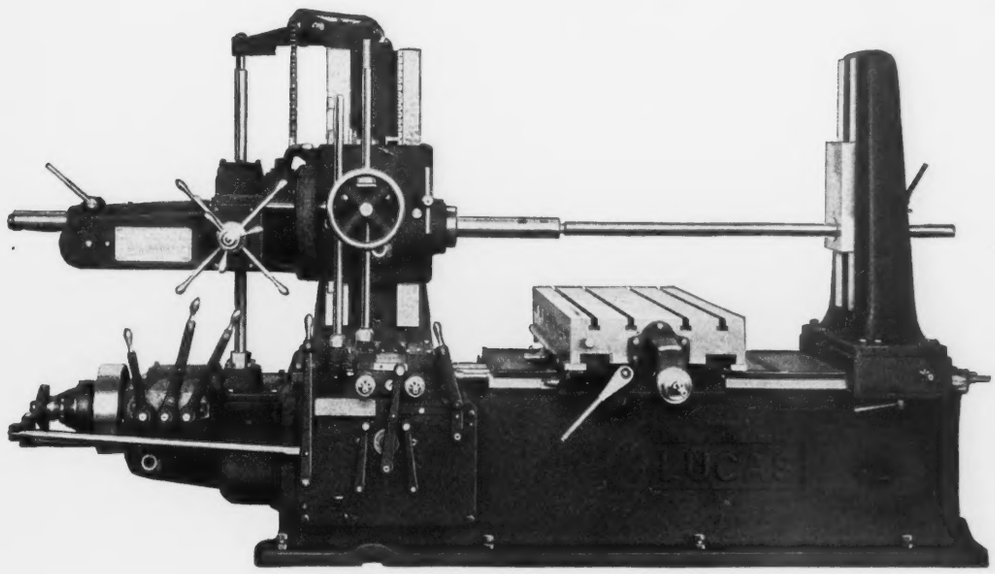
Plan Now to Visit Cleveland

September 30th-October 4th

Among the Attractions at the
National Machine Tool Builders' Exposition
will be the **NEW MODEL**

LUCAS "PRECISION"

Horizontal Boring Machines



An added incentive is the opportunity to visit the shop where they are made, at East 99th Street and N. Y. Central R. R.

The LUCAS Power Forcing Press will be exhibited also.

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio, U.S.A.

FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm. R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Emanuele Mascherpa, Milan, Italy.

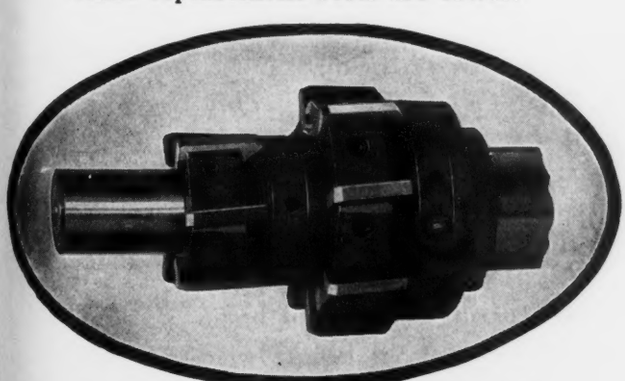
A distinctive feature of this Wetmore Shell Reamer is the $\frac{1}{8}$" projection of the blades over the end of the reamer body for chip clearance. This allows the chips to fall off ahead of the reamer body and prevents chips from clogging up along cutting edge of blades.

Wetmore Shell Reamers have .087" adjustment oversize. Made in these sizes: 1¼" to 3", 6 blades; 3-1/16" to 5", 8 blades; 5-1/16" to 6", 10 blades. Larger sizes made on order. Made also with straight hole, if desired. Sizes above 1¾" readily adaptable for line reaming.

Why Big Plants Specify WETMORE Shell Reamers

More than one user has told us that Wetmore Shell Reamers have done work they thought would be too much for any reamer.

But Wetmore Reamers have the habit of making good on hard jobs. We guarantee them to lower your production costs. They do faster work; they stand up longer; blade replacement costs are lower.



Above is shown how Wetmore Shell Reamers can be adapted for pilot reaming in combination or single.

Wetmore Shell Reamers are adaptable for either line or pilot reaming. Body, lock nut, and cone nut are finest alloy steel, heat-treated. Left-hand angle blades are staggered to eliminate chattering.

Send for Catalog No. 29

—showing the full line of Wetmore adjustable reamers. This is a New Catalog—sent free, postpaid, on request.

WETMORE REAMER CO.

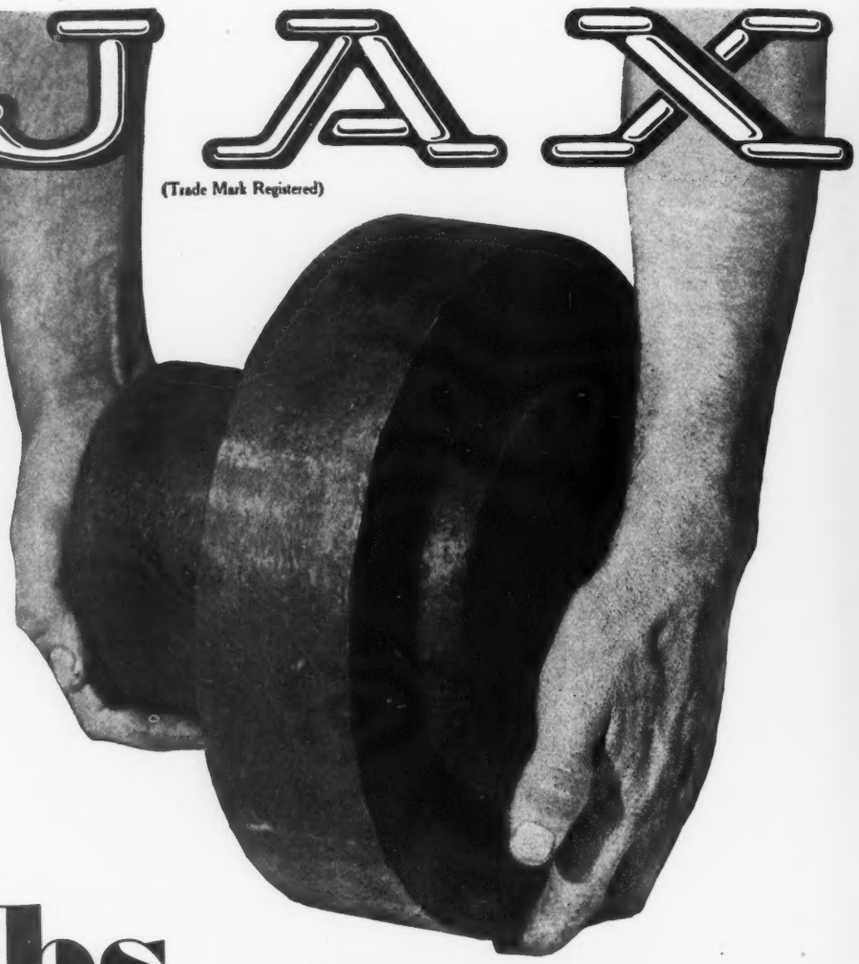
60—27th ST., MILWAUKEE, WIS.

WETMORE ADJUSTABLE REAMERS

"THE BETTER REAMER"

AJAX

(Trade Mark Registered)



Weight 78 lbs.
Max. Diameter 10¼ in.
Diameter of Hole 3 in.
Stock 4¾ in.

47 lbs. LESS STEEL TO FORGE AND MACHINE AWAY

AN Ajax Upsetting Forging Machine made this 78-pound upset forging to replace a 125-pound hammer forging.

It held the outside close to finished dimensions, punched a concentric hole, saved 47 pounds of steel from the scrap bin and many hours of useless machining.

It did this at a speed far ahead of the hammer, and required less power and less effort on the part of the operator.

This feat was not out of the ordinary. You will be paid for seeing what this machine can do for you.

Ajax Heavy Duty Upsetting Forging Machines will produce upsets up to 15 inches in diameter

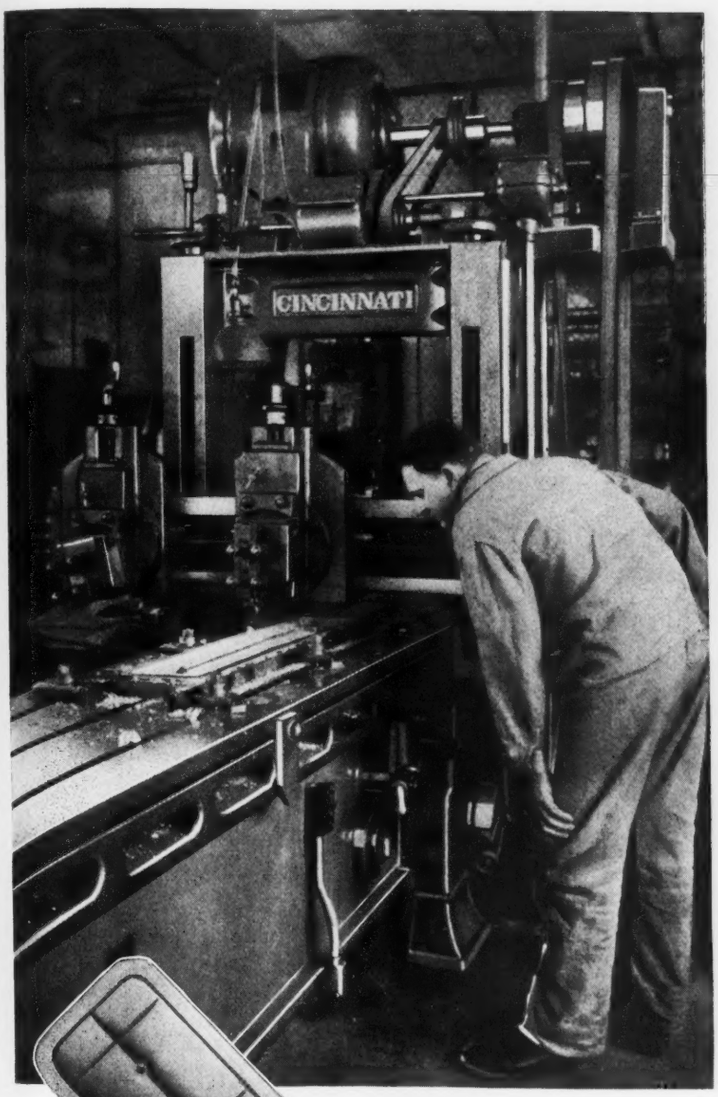
THE AJAX MANUFACTURING COMPANY

621 Marquette Building
Chicago

CLEVELAND

1369 Hudson Terminal Bldg.
New York, N. Y.

Wright Motors Praises Cincinnati "Hypro"



The selection of Cincinnati "Hypro" by Wright Motors for the important and exacting work of their Experimental Department is a high compliment to the machine. And that the "Hypro" has justified its selection is well attested in a report received from Wright Aeronautical Corp., Paterson, N. J., which says in part, "The planer is rendering excellent service and meeting all requirements."

The photographs were taken during a planing operation on an aluminum crankcase cover for an inverted air-cooled Wright engine. The "Hypro" is planing the bearing surface, removing ⅛" stock, and the prime requisites of the job are high accuracy and a fine, smooth finish.

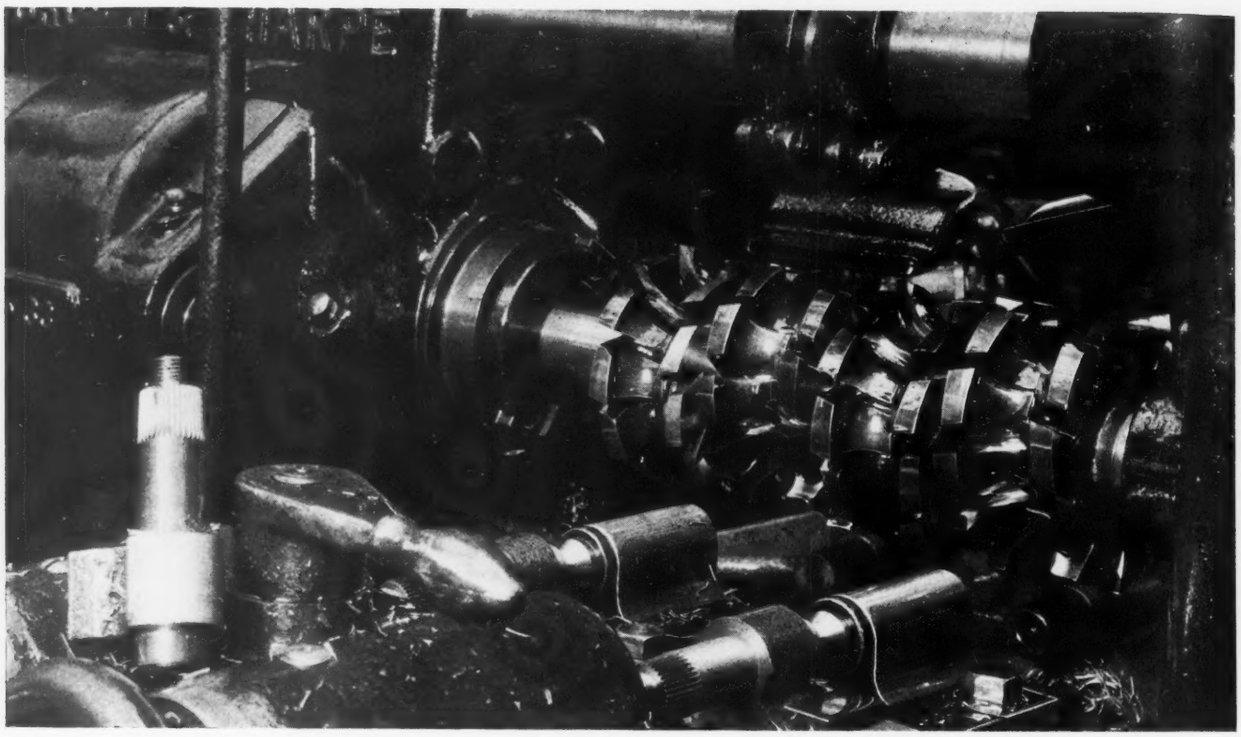
The "Hypro" fills every requirement in this shop for a high-speed, modern planer. It is used to plane surfaces on a wide range of parts, such as crankcase covers, crankcases, crankshafts, camshaft housings, and many others. The machine has been in service 60 hours a week since its installation ten months ago.

Write for catalogs and other informative matter on the Cincinnati "Hypro"

The Cincinnati Planer Co.
Cincinnati, Ohio

"HYPRO" PLANERS

CUTTERS *that keep pace with*



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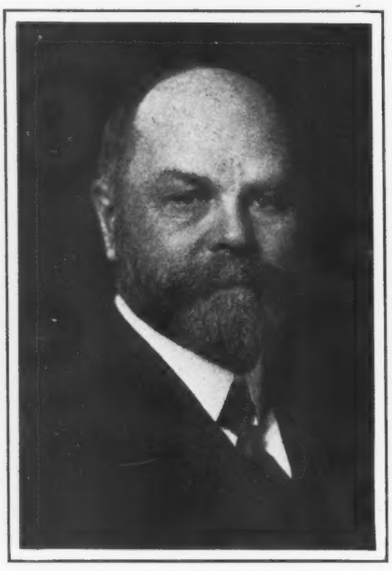

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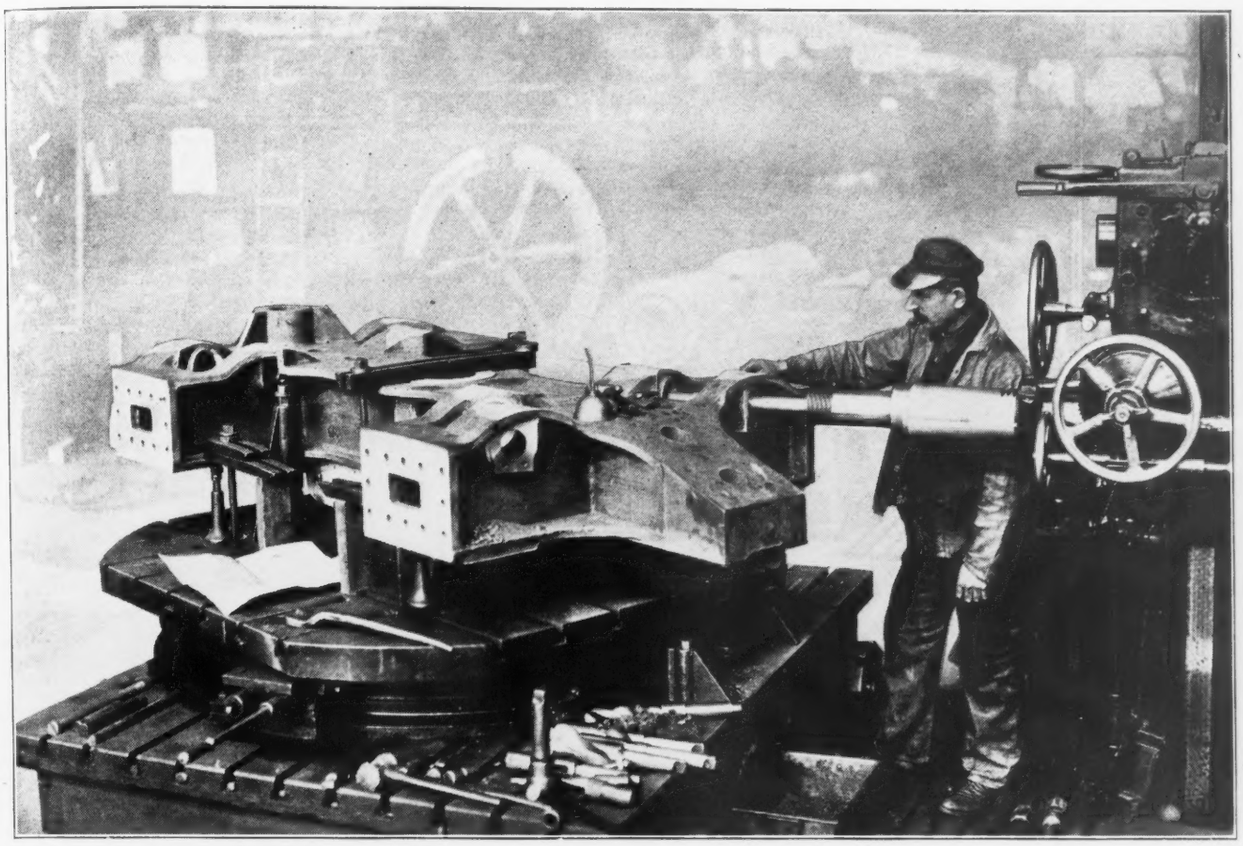
* * *

The June production of automobiles reached over 536,000 cars, trucks, and buses, according to the National Automobile Chamber of Commerce. A new record for the production in any six-month period was established during the first six months of 1929, with a total output of 3,380,000 cars and trucks. This exceeds the output during the same period in 1928 by 1,053,000 vehicles. The output in June was nearly 100,000 cars less than in May, and a seasonal decline is now expected following the high pace set by the industry during the first six months of the year.



Drilling and tapping a cast iron Base Plate with a Horizontal Drilling and Boring Machine. The entire job—totaling 118 operations—handled with the one set-up.

Save Time and Labor — Handle the Entire Job from the One Set-Up

One simple set-up—then uninterrupted operation. Drill the entire job—four sides—from the one setting, on a simple rotary table.—Or drill five sides on ordinary work with a universal tilting and revolving table.

The set-up job is easier too. The worktable is at the side of the drill with no overhanging parts to interfere. Drilling, too, is faster and cleaner. Drilling pressure is against a heavy vertical column. The chips fall away from the hole, keeping the drill clean.

The Horizontal Drill simplifies the handling of difficult pieces. It gives you a wider range of operation and greater ease in handling the general run of work. It will show a big saving in floor to floor time.

Write for complete information, specifications, and prices. Ask for Bulletin A-4051.

JOSEPH T. RYERSON & SON INC.

ESTABLISHED 1842

Chicago, Milwaukee, St. Louis, Cincinnati, Detroit, Cleveland, Buffalo, Pittsburgh, Philadelphia, Boston, Jersey City, New York, Richmond, Houston, Tulsa, Rockford, Kansas City, Los Angeles, San Francisco, Denver, Minneapolis, Duluth.

RYERSON

MACHINERY-SERVICE

COMING EVENTS

AUGUST 20-28—Fifth Annual Industrial Leadership Course at Silver Bay, Lake George, N. Y., under the auspices of the Industrial Department of the National Council of Young Men's Christian Associations, 347 Madison Ave., New York City.

AUGUST 26-28—Aeronautic meeting of the Society of Automotive Engineers at the Hollenden Hotel, Cleveland, Ohio. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

AUGUST 28-SEPTEMBER 1—Twelfth annual conference on Human Relations in Industry at Silver Bay, Lake George, N. Y., under the auspices of the Industrial Department of the National Council of Young Men's Christian Associations, 347 Madison Ave., New York City.

SEPTEMBER 9-11—Fall meeting of the Institute of Metals Division, American Institute of Mining and Metallurgical Engineers in Cleveland, Ohio. W. M. Corse, secretary, 810 Eighteenth St., N.W., Washington, D. C.

SEPTEMBER 9-12—Fall meeting of the American Welding Society in Cleveland, Ohio. M. M. Kelly, secretary, 33 W. 39th St., New York City.

SEPTEMBER 9-12—Fall meeting of the Iron and Steel Division, American Institute of Mining and Metallurgical Engineers in Cleveland, Ohio. H. Foster Bain, secretary, 29 W. 39th St., New York City.

SEPTEMBER 9-13—Annual convention of the American Society for Steel Treating at Cleveland, Ohio. W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland, Ohio.

SEPTEMBER 9-13—National Metals Congress in Cleveland, Ohio. Simultaneous meetings with the American Welding Society; Institute of Metals Division, American Institute of Mining and Metallurgical Engineers; Iron and Steel Division, American Society of Mechanical Engineers; Iron and Steel Division, American Institute of Mining and Metallurgical Engineers; and American Society for Steel Treating.

SEPTEMBER 9-13—Eleventh National Metal Exposition under the auspices of the American Society for Steel Treating at the Cleveland Public Auditorium, Cleveland, Ohio. For further information, address W. H. Eisenman, secretary, 7016 Euclid Ave., Cleveland.

SEPTEMBER 11-13—Fall meeting of the Iron and Steel Division, American Society of Mechanical Engineers in Cleveland, Ohio. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

SEPTEMBER 19—Meeting of the Electric Hoist Manufacturers Association in New York City. Secretary, E. Donald Tolles, 165 Broadway, New York City.

SEPTEMBER 30-OCTOBER 2—Eighth annual convention of the National Industrial Advertisers Association in Cincinnati, Ohio. Chairman of the Convention Committee, Jesse R. Harlan, advertising and sales manager of the Stuebing-Cowan Co., Cincinnati, Ohio.

SEPTEMBER 30-OCTOBER 4—Machine Tool Exposition held by the National Machine Tool Builders' Association in the Public Auditorium, Cleveland, Ohio. Ernest F. DuBrul, general manager, 1415 Enquirer Building, Cincinnati, Ohio.

SEPTEMBER 30-OCTOBER 4—Machine Tool Congress to be held in Cleveland, Ohio, jointly with the Production Meeting of the Society of Automotive Engineers and the Machine Shop Practice Division Meeting of the American Society of Mechanical Engineers. For further information, address E. F. DuBrul, National Machine Tool Builders' Association, 1415 Enquirer Building, Cincinnati, Ohio.

OCTOBER 2-4—Production meeting of the Society of Automotive Engineers to be held at Hotel Cleveland, Cleveland, Ohio. Coker F. Clarkson, secretary, 29 W. 39th St., New York City.

OCTOBER 7-10—Annual meeting of the National Electrical Manufacturers Association at the Wardman Park Hotel, Washington, D. C. For further information, address Albert Pfaltz, National Electrical Manufacturers Association, 420 Lexington Ave., New York City.

OCTOBER 7-12—First National Electrical Exposition to be held at the Grand Central Palace, New York City, under the joint auspices of the Electrical Board of Trade of New York and the New York Electric League. For further information, address E. F. Korbel, 441 Lexington Ave., New York City.

OCTOBER 24-26—Semi-annual meeting of the American Gear Manufacturers' Association at Briarcliff Lodge, Briarcliff Manor, N. Y. T. W. Owen, Secretary, 3608 Euclid Ave., Cleveland, Ohio.

DECEMBER 2-6—Annual meeting of the American Society of Mechanical Engineers at the Engineering Societies Building, 29 W. 39th St., New York City. Calvin W. Rice, secretary, 29 W. 39th St., New York City.

NEW BOOKS AND PAMPHLETS

ROLLING MILL ROLLS. A bibliography by Victor S. Polansky. 59 pages, 5 by 7 inches. Distributed by the Carnegie Library of Pittsburgh, Pittsburgh, Pa.

ROLLING TESTS OF PLATES. By Wilbur M. Wilson. 60 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 191 of the Engineering Experiment Station. Price, 30 cents.

INVESTIGATION OF HEATING ROOMS WITH DIRECT STEAM RADIATORS EQUIPPED WITH ENCLOSURES AND SHIELDS. By Arthur C. Willard, Alonzo P. Kratz, Maurice K. Fahnestock, and Seichi Konzo. 72 pages, 6 by 9 inches. Published by the University of Illinois, Urbana, Ill., as Bulletin No. 192 of the Engineering Experiment Station. Price, 40 cents.

FORMULAS IN GEARING. 265 pages. Published by the Brown & Sharpe Mfg. Co., Providence, R. I. Price, $1.50.

This is a revision of a book dealing with gearing formulas. Considerable new material has been added in the new edition, including calculations for long and short addendum for spur gears and stub tooth gears; data on generated straight tooth and spiral bevel gears, using the Gleason Works system; strength of both metallic and non-metallic gears, including outline factors for 14 1/2- and 20-degree pressure angles and 20-degree stub tooth gears, based on the diametral and circular pitches; diagrams for the solution of right-angle and oblique-angle triangles; and logarithms for gear ratios from 24/100 to 100/24, inclusive.

X-RAYS IN INDUSTRY. 60 pages, 5 1/2 by 8 1/2 inches. Distributed by the Eastman Kodak Co., Rochester, N. Y.

X-ray photography is being increasingly used to determine the internal structure of inanimate objects. Steel castings, aluminum castings, metal radio transmission tubes, and a variety of other metal objects have been subjected to X-ray examination, and such examination has become standard practice in some factories. The principal work along these lines has been done in the Watertown Arsenal, the Massachusetts Institute of Technology, and the Woolwich Arsenal in England. This information, as part of a brief survey of the theory and use of X-rays in industry, is included in this booklet. The booklet should stimulate manufacturers to visualize many applications of radiography peculiar to their own business.

ENGINEERING INDEX FOR 1928 (Two Volumes). 2000 pages, 7 3/4 by 10 1/2 inches. Published by the American Society of Mechanical Engineers, 29 W. 39th St., New York City. Price, one hundred twenty-five dollars.

This work is an outgrowth of an engineering index that has been issued annually for the last forty-five years and that has come to be recognized as an authentic guide to periodical technical literature. The present index, however, differs radically from preceding ones in that it is far more comprehensive. It has been extended in scope to include every branch of engineering in seventeen languages, and may be said to be the first encyclopedic bibliography of periodical engineering literature ever published. The work contains a classified list of articles appearing in the technical press throughout the world during the year 1928. The present edition includes 75,000 reference items covering 1700 periodicals. These items are all accurately classified under alphabetically arranged subheadings and carefully cross-indexed, the material being so voluminous that it requires two books of 1000 pages each. A sufficient description of the article is given in each case for the reader to obtain an adequate conception regarding its probable value for his purpose. The name, date, and address of the publication in which the article appeared are also given. A new feature of the present edition is an authors' index. In its present comprehensive form, this work should be an invaluable guide for use in public and corporation libraries, government departments, industrial organizations, and educational institutions.

REPORT OF THE NATIONAL SCREW THREAD COMMISSION. 261 pages, 6 by 9 inches. Published by the United States Department of Commerce, Miscellaneous Publication, Bureau of Standards, No. 89. Price, 50 cents. (Copies may be procured from the Superintendent of Documents, Government Printing Office, Washington, D. C.)

This is the third report of the National Screw Thread Commission, and it is a revision made in 1928 of the 1924 report. A number of important revisions have been made in the American National (formerly National) Screw Thread Series, including additional data and the substitution of tables of specific pitch-diameter tolerances for threads of special diameters, pitches, and lengths of engagement, in place of the method of determining such tolerances by adding together increments. The specifications for threading tools have been revised extensively. There is considerable new material, such as the American National bolt and nut proportions; screw threads for oil-well drilling equipment, including pipe, casing, line pipe, and other specifications published by the American Petroleum Institute; standard hose connections for welding and cutting torches; rolled threads for screw shells for electric sockets and lamp bases; standard designs of plain and threaded plug and ring gages; common practice as to the thread series and classes of fits for different applications of screws, bolts, and nuts; and an outline of standard practice for Acme screw threads. This outline of practice gives general specifications, the classification of fits, and tables and formulas for allowance and tolerance values, and is followed by specifications and data for Acme thread gages. Tools for producing Acme screw threads are dealt with in the appendix, where dimensions and tolerances for Acme taps are also given. This report is illustrated throughout by drawings wherever needed, and it gives most of the data in tabular form.

NEW CATALOGUES AND CIRCULARS

PULLEYS. T. B. Wood's Sons Co., Chambersburg, Pa. Bulletin 272, containing data on ball-bearing loose pulleys.

ELECTRIC STARTERS. Lincoln Electric Co., Cleveland, Ohio. Circular descriptive of Lincoln "Across-line" safety starters.

LIGHTING EQUIPMENT. Crouse-Hinds Co., Syracuse, N. Y. Bulletin 2134, descriptive of a new floodlight for universal service.

STEEL CASTINGS. Lebanon Steel Foundry, Lebanon, Pa. Circular illustrating the use of Lebanon steel castings in motor mowers and lawn tractors.

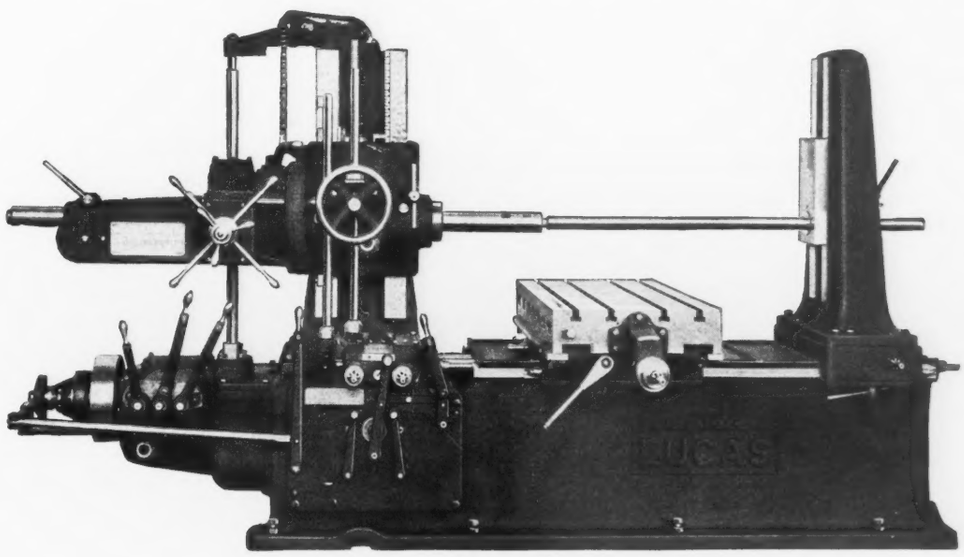
ELECTRIC STARTERS. Electric Controller & Mfg. Co., Cleveland, Ohio. Circular illustrating a variety of applications of E. C. & M. automatic synchronous motor starters.

Plan Now to Visit Cleveland

September 30th-October 4th

Among the Attractions at the
National Machine Tool Builders' Exposition
will be the **NEW MODEL**

LUCAS "PRECISION"
Horizontal Boring Machines



An added incentive is the opportunity to visit the shop where they are made, at East 99th Street and N. Y. Central R. R.

The LUCAS Power Forcing Press will be exhibited also.

THE LUCAS MACHINE TOOL CO., Cleveland, Ohio, U.S.A.

FOREIGN AGENTS: Allied Machinery Co., Barcelona, Zurich. V. Lowener, Copenhagen, Oslo, Stockholm, R. S. Stokvis & Zonen, Paris and Rotterdam. Andrews & George Co., Tokyo. Ing. M. Kocian & G. Nedela, Prague. Emanuele Mascherpa, Milan, Italy.

HARDENING EQUIPMENT. Leeds & Northrup Co., 4901 Stenton Ave., Philadelphia, Pa. Pamphlet No. 19 in a heat-treating series, dealing with the hardening of tools by the Hump method.

MONEL METAL AND NICKEL. International Nickel Co., Inc., 67 Wall St., New York City. Pamphlet containing instructions for welding, brazing, and soldering Monel Metal and pure nickel.

AUTOMATIC WIRE-FORMING MACHINERY. Baird Machine Co., Bridgeport, Conn. Circular illustrating Baird automatic wire-forming machines, presses, and horizontal chucking machines.

BAROMETER AND VACUUM RECORDER FOR STEAM TURBINES. Uehling Instrument Co., 473 Getty Ave., Paterson, N. J. Bulletin 150, describing the Uehling combined barometer and vacuum recorder for steam turbines.

ELECTRICAL HEATING EQUIPMENT. General Electric Co., Schenectady, N. Y. Pamphlet illustrating and describing GE industrial heating devices, including soldering irons, glue pots, immersion heaters, cartridge units, melting pots, electric furnaces, etc.

ROLLED ZINC. New Jersey Zinc Co., 160 Front St., New York City. Pamphlet dealing with rolled zinc. Among the subjects covered are rolling mill tolerances, methods of testing, fabrication of rolled zinc, soldering, painting, finishes, physical properties, and uses.

FLEXIBLE COUPLINGS. Brown Engineering Co., 133 N. 3rd St., Reading, Pa. Bulletin 28, describing the constructional features of "Kanti-Lever" flexible couplings. The bulletin also contains prices and dimensions, as well as information on how to select couplings.

BUTT-WELDING MACHINES. Federal Machine & Welder Co., Dana Ave., Warren, Ohio. Bulletin 60, describing the construction and advantages of Federal butt-welding machines. Typical examples of the class of work handled on these machines are illustrated.

AIR COMPRESSORS. Allen Air Appliance Co., Inc., Grand Central Terminal, 452 Lexington Ave., New York City. Circular treating of the mechanical characteristics of Triple A centrifugal air compressors, and their application in various classes of service. Tables of sizes and capacities are included.

BALL BEARINGS. New Departure Mfg. Co., Bristol, Conn. Sheets for loose-leaf catalogue, dealing with the advantages of ball bearings in general machinery application, and containing tables giving principal dimensions and load ratings of single-row bearings, double-row bearings, and radax bearings.

WELDING MACHINES. Acme Electric Welder Co., 5621A Pacific Blvd., Los Angeles, Calif., is distributing a series of bulletins entitled "The Acme of Metal Joinery," describing the different groups of Acme "hot spot" welding machines, which are made in styles suitable both for light and heavy-duty service.

PULLEYS. Henry Lindahl Foundry & Machine Co., 5900 Ogden Ave., Chicago, Ill. Catalogue 22, covering the complete line of Lindahl pulleys. The catalogue gives dimensions and prices of machine molded pulleys, ball-bearing loose pulleys, steel and wood split pulleys, paper pulleys, wire rope hoisting sheaves, belt pulleys, etc.

MAGNETIC SEPARATORS. Magnetic Mfg. Co., Milwaukee, Wis. Bulletin 90, devoted to the magnetic separation of flour, feed, cereal, cotton seed, pulverized coal, lime, gypsum, and other materials of a similar nature. The bulletin shows a number of types and designs of machines especially adapted for use where dust prevention is necessary and fire hazards are encountered.

ELECTRIC EQUIPMENT. Electric Controller & Mfg. Co., Cleveland, Ohio. Bulletins 970, 1010, 1021, and 1037-D, describing, respectively, controllers for alternating-current slip-ring motors, solenoids for direct current, crane switchboards for direct-current motors, and limit stops for alternating- and direct-current motors. A price sheet accompanies each of these bulletins.

GEAR INSPECTION MACHINE. Fellows Gear Shaper Co., Springfield, Vt. Booklet descriptive of the "Red Liner," a machine for charting automatically a permanent record of errors in gears under conditions closely approaching those of actual operation. The machine is described in detail, and a number of characteristic charts are reproduced, showing errors in gears which have been tested with this machine.

PLATING EQUIPMENT. Hanson-Van Winkle-Munning Co., 109 Church St., Matawan, N. J. Bulletins A-103, B-101, E-515, M-100, M-101, and M-103, illustrating and describing, respectively, Hanson-Munning anodes for electroplating; buffs, compositions, and cleaners; low-voltage generators for electroplating and similar uses; Optimus type E plating barrels; oblique and jewelers' plating barrels; and semi-automatic plating conveyors.

MATERIAL HANDLING EQUIPMENT. Cleveland Electric Tramrail Division of the Cleveland Crane & Engineering Co., Wickliffe, Ohio. Circular illustrating the use of Cleveland tramrail systems for transporting bales under all sorts of conditions. Circular illustrating the use of the Cleveland tramrail system on foundry handling jobs. Circular showing the application of the Cleveland tramrail system in handling flasks, patterns, cores, and molds.

LATHES. South Bend Lathe Works, 746 E. Madison St., South Bend, Ind. New general catalogue No. 90-A, containing illustrations, descriptions, and prices of the entire South Bend line of lathes from the 9-inch to the 18-inch size. Several new models are shown in the present edition, and a number of new lathe attachments are also shown for the first time. A section is devoted to the new model tool-room precision lathe, which is built in sizes of from 11 to 18 inches.

SILENT CHAIN DRIVES. Ramsey Chain Co., Inc., 1039 Broadway, Albany, N. Y. Catalogue 628, on Ramsey silent chain drives. Following a description of the mechanical features, an outline is given of the field of application, illustrated by numerous halftones showing the use of these drives in a wide variety of industries. The last part of the book contains general data, including tables of chain speeds, standard hub diameters, chain lengths, tables of sprockets, etc.

ELECTRICAL EQUIPMENT. General Electric Co., Schenectady, N. Y. Bulletins GEA 86A, 394A, 722A, 782A, 874D, 875D, 904B, 970A, 1104, 1105, 1125, 1138, and 1142, illustrating and describing, respectively, single-phase directional over-current relays; induction motor-generator sets; Selsyns for remote signaling, control, and indication; outdoor station equipment; type WD-200A arc welder; type WD-300A arc welder; single-stage centrifugal air compressors for cupola blowing; type PQ relays; motor drive for metal-working machinery; under-voltage devices for oil circuit-breakers; GE arc-welding school; self-contained pillars; type EW resistors for mine and industrial haulage locomotives.

ELECTRIC EQUIPMENT. Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa. Leaflet 20,388, describing the new line of Class 12-700 type A reversing drum controllers for wound rotor induction motors. Folder 5179, descriptive of the many features of Westinghouse steel panels for switchboards. Folder 5181, entitled "Quality Switchboards," outlining the important advantages of steel switchboards and the distinctive features of Westinghouse switchboards. Folder 5188, illustrating and describing the Westinghouse direct-current totally enclosed fan-cooled type SK motor, for use where the motor must be protected from dust, fumes, or abrasive material. Special publication 1842, descriptive of line-starters and line-start motors.

DIAMONDS USED AS CUTTING TOOLS

Tools pointed with diamonds have been regularly used in the past for dressing grinding wheels and for cutting hardened steel and other materials that were too hard to be cut by steel tools. It is a more recent discovery that diamond tools can be used economically in machining a number of softer materials, particularly those on which steel tools do not have a satisfactory life. The *S. A. E. Journal* calls attention to the fact that among the materials most commonly considered suitable to be machined with diamond tools today are hard rubber, vulcanized fiber, ebonite, vulcanite, mica, "felt" paper rolls, bronze, bearing metals, aluminum, copper, monel metal, and malleable iron. All these materials are more severe in their effects on steel turning tools than their hardness and tenacity would indicate, and it is difficult to obtain a smooth finish on them with a steel tool.

The diamond tool can be run at such a high speed that it is practicable to take a very fine cut; this, with a marked freedom from tearing effect, makes it possible to obtain a smoothness of finish that can be produced by no other method of machining. In turning aluminum, copper, and malleable iron, the diamond tool does not tear the metal and leave it rough, as a steel tool does. To make the most of its ability to give a smooth finish, the feed of a diamond tool should be very fine and the speeds very high.

GERMAN MACHINERY EXPORTS

One of the main features of Germany's commercial policy since the war has been to re-establish and expand her markets for machinery in eastern Europe, including Russia. These efforts have been very successful, German exports of machinery to eastern Europe having risen from a value of about $18,000,000 in 1924 to $60,000,000 in 1928. In the latter year over 20 per cent of the German machinery exports went to the eastern European market. Russia absorbs more than half and Poland about 25 per cent of the exports going to that part of Europe. Finland is also an important buyer of German machinery. The machinery exports to eastern Europe included machine tools valued at over $10,000,000, of which Russia absorbed machines to a value of about $7,500,000 and Poland about $2,000,000 worth.

* * *

The Amtorg Trading Corporation, 261 Fifth Ave., New York City, announces that during the nine months, October 1, 1928 to July 1, 1929, the Soviet Union bought about $18,000,000 worth of industrial machinery in the United States, which was 60 per cent more than the purchases for the entire preceding twelve months. Sales of Soviet products in the United States during the nine-month period mentioned reached a total of nearly $20,000,000, a gain of about $3,000,000 over the corresponding period a year ago.

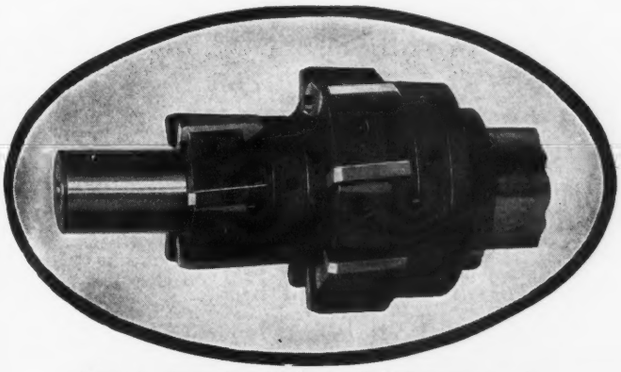
A distinctive feature of this Wetmore Shell Reamer is the ⅛" projection of the blades over the end of the reamer body for chip clearance. This allows the chips to fall off ahead of the reamer body and prevents chips from clogging up along cutting edge of blades.

Wetmore Shell Reamers have .087" adjustment oversize. Made in these sizes: 1¼" to 3", 6 blades; 3-1/16" to 5", 8 blades; 5-1/16" to 6", 10 blades. Larger sizes made on order. Made also with straight hole, if desired. Sizes above 1¾" readily adaptable for line reaming.

Why Big Plants Specify WETMORE Shell Reamers

More than one user has told us that Wetmore Shell Reamers have done work they thought would be too much for any reamer.

But Wetmore Reamers have the habit of making good on hard jobs. We guarantee them to lower your production costs. They do faster work; they stand up longer; blade replacement costs are lower.



Above is shown how Wetmore Shell Reamers can be adapted for pilot reaming in combination or single.

Wetmore Shell Reamers are adaptable for either line or pilot reaming. Body, lock nut, and cone nut are finest alloy steel, heat-treated. Left-hand angle blades are staggered to eliminate chattering.

Send for Catalog No. 29

—showing the full line of Wetmore adjustable reamers. This is a New Catalog—sent free, postpaid, on request.

WETMORE REAMER CO.

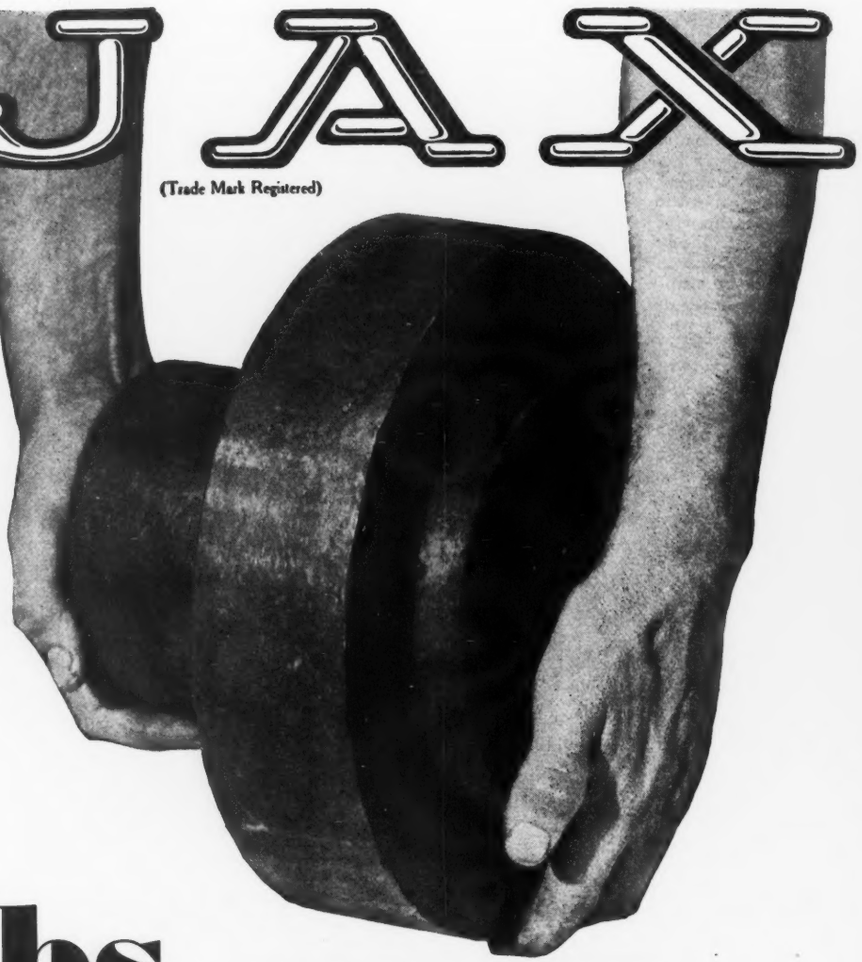
60—27th ST., MILWAUKEE, WIS.

WETMORE ADJUSTABLE REAMERS

"THE BETTER REAMER"

AJAX

(Trade Mark Registered)



Weight 78 lbs.
Max. Diameter 10¼ in.
Diameter of Hole 3 in.
Stock 4¾ in.

47 lbs. LESS STEEL TO FORGE AND MACHINE AWAY

AN Ajax Upsetting Forging Machine made this 78-pound upset forging to replace a 125-pound hammer forging.

It held the outside close to finished dimensions, punched a concentric hole, saved 47 pounds of steel from the scrap bin and many hours of useless machining.

It did this at a speed far ahead of the hammer, and required less power and less effort on the part of the operator.

This feat was not out of the ordinary. You will be paid for seeing what this machine can do for you.

Ajax Heavy Duty Upsetting Forging Machines will produce upsets up to 15 inches in diameter

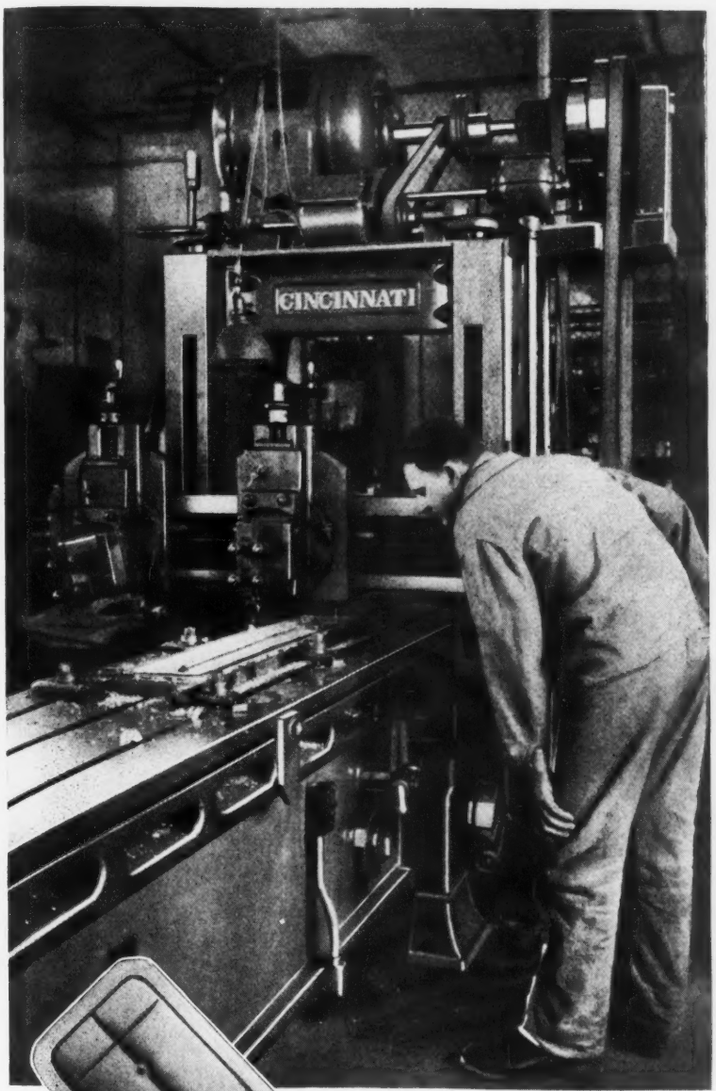
THE AJAX MANUFACTURING COMPANY

621 Marquette Building
Chicago

CLEVELAND

1369 Hudson Terminal Bldg.
New York, N. Y.

Wright Motors Praises Cincinnati "Hypro"



The selection of Cincinnati "Hypro" by Wright Motors for the important and exacting work of their Experimental Department is a high compliment to the machine. And that the "Hypro" has justified its selection is well attested in a report received from Wright Aeronautical Corp., Paterson, N. J., which says in part, "The planer is rendering excellent service and meeting all requirements."

The photographs were taken during a planing operation on an aluminum crankcase cover for an inverted air-cooled Wright engine. The "Hypro" is planing the bearing surface, removing ⅛" stock, and the prime requisites of the job are high accuracy and a fine, smooth finish.

The "Hypro" fills every requirement in this shop for a high-speed, modern planer. It is used to plane surfaces on a wide range of parts, such as crankcase covers, crankcases, crankshafts, camshaft housings, and many others. The machine has been in service 60 hours a week since its installation ten months ago.

Write for catalogs and other informative matter on the Cincinnati "Hypro"

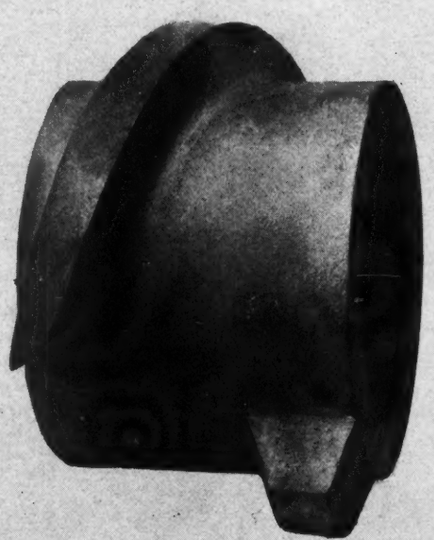
The Cincinnati Planer Co.
Cincinnati, Ohio

"HYPRO" PLANERS

TRANSUE

Exceptional

Machine Forging



Finished Part

WILLIAMS

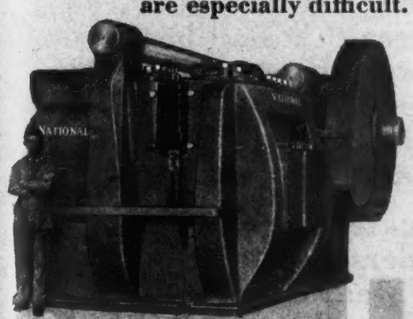
Forgings

THE Transue & Williams Steel Forging Corporation of Alliance, Ohio, equipped with the newest type forging machines, are making forgings which until recently were not thought possible. The accompanying illustration of one of their interesting forgings is an example of the work done in their shop.

This worm gear forging was made by Transue & Williams for a special screw press. Due to its size and unusual shape, this piece was formerly made solid and then bored and machined to the desired specifications. Obviously, modern forging equipment enables the supplier to materially reduce the machining problems of his customer.

Users of the new National High Duty Forging Machines, thru the cooperation of our engineers and the use of National die methods, are developing many unique and profit-making forgings. The broadening market for forge shop products is, to no small extent, due to this type of progress.

The commercial forge shops in your district equipped with these new type machines can supply you with these dividend-producing forgings. National engineers are, of course, always at your service, if your forging problems are especially difficult.



A 5 inch National High Duty Forging Machine.

National High Duty Forging Machines are sold by

CHAMBERSBURG-NATIONAL

COMPLETE FORGING EQUIPMENT

Offices at

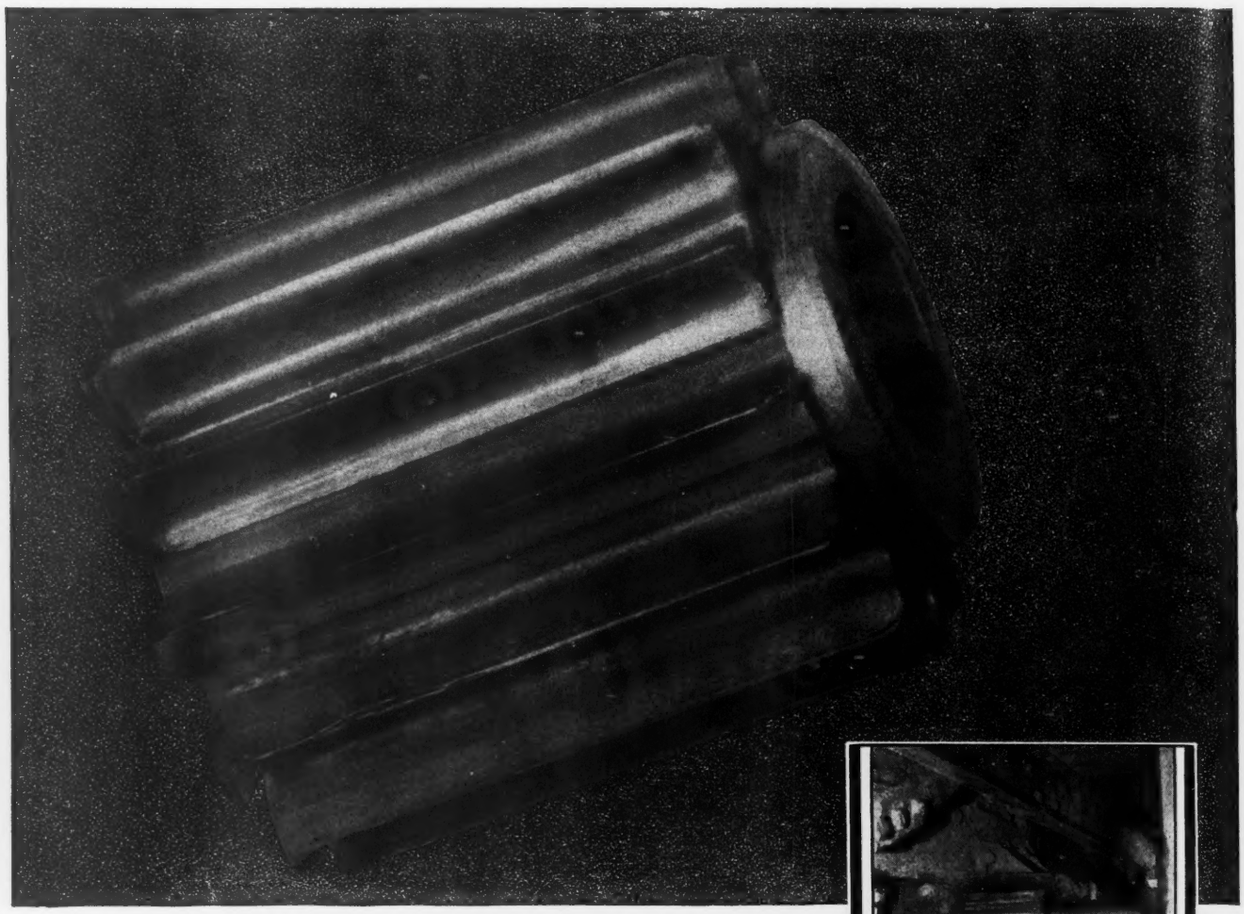
CHAMBERSBURG, PA. TIFFIN, OHIO

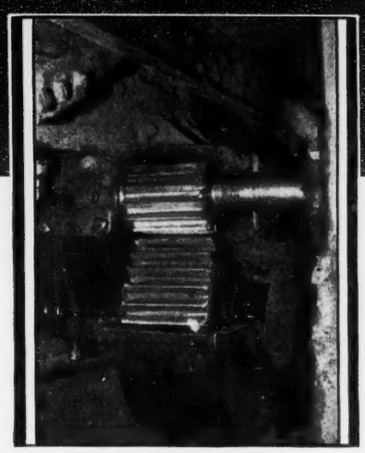
NEW YORK, 152 W. 42nd St. CHICAGO, 565 W. Washington St.

DETROIT, 2457 Woodward Avenue

The National Machinery Company

Tiffin, Ohio, U. S. A.





You Should See The Other 13 "Fellows"

This one sand mill pinion, cast from Sivyer Chrome Nickel Steel, did the work of 13 ordinary castings. It withstood, for an entire year, the severe, abrasive wear that had been sending other pinions to the scrap heap every three or four weeks. Even after a year, the Sivyer pinion showed no cracks—no fractures—no bent teeth. And the Scotch plant engineer insisted it was good for at least another month.

Service such as this, which has been duplicated for two successive years, explains why industrial leaders have come to think of resistance to hard and abusive wear in terms of Sivyer alloys.

SIVYER STEEL

SIVYER STEEL CASTING COMPANY, MILWAUKEE

...is it OILGEAR *equipped?*

WHEN looking through catalogs of machinery you frequently see such phrases as "hydraulic oil feed", "stepless speed range", etc. The maker may or may not have stated that the feed is Oilgear. When you come to actual inspection of this equipment, however, *look for the Oilgear* trade-mark on the feed unit.

This mark identifies the genuine Oilgear Feed—the one proven faster, proven more economical. You find it featured by more than seventy machinery builders today because of the performance that it alone provides. Faster work . . . . better work . . . lower machine maintenance . . . . less tool breakage. Machines using the Oilgear Feed will give you greater production *at a lower cost per piece.* Be sure you get the genuine.

The OILGEAR Company
660 Park Street Milwaukee, Wis.

For Your Protection

OILGEAR

Reg. U. S. Pat. Off.

This trade-mark appears on the name plate attached to the pump unit of every genuine Oilgear Feed.

The makers of the Swift Butt Welder state that "the Oilgear system of control . . . is a much cheaper method than by the hydraulic accumulator system."

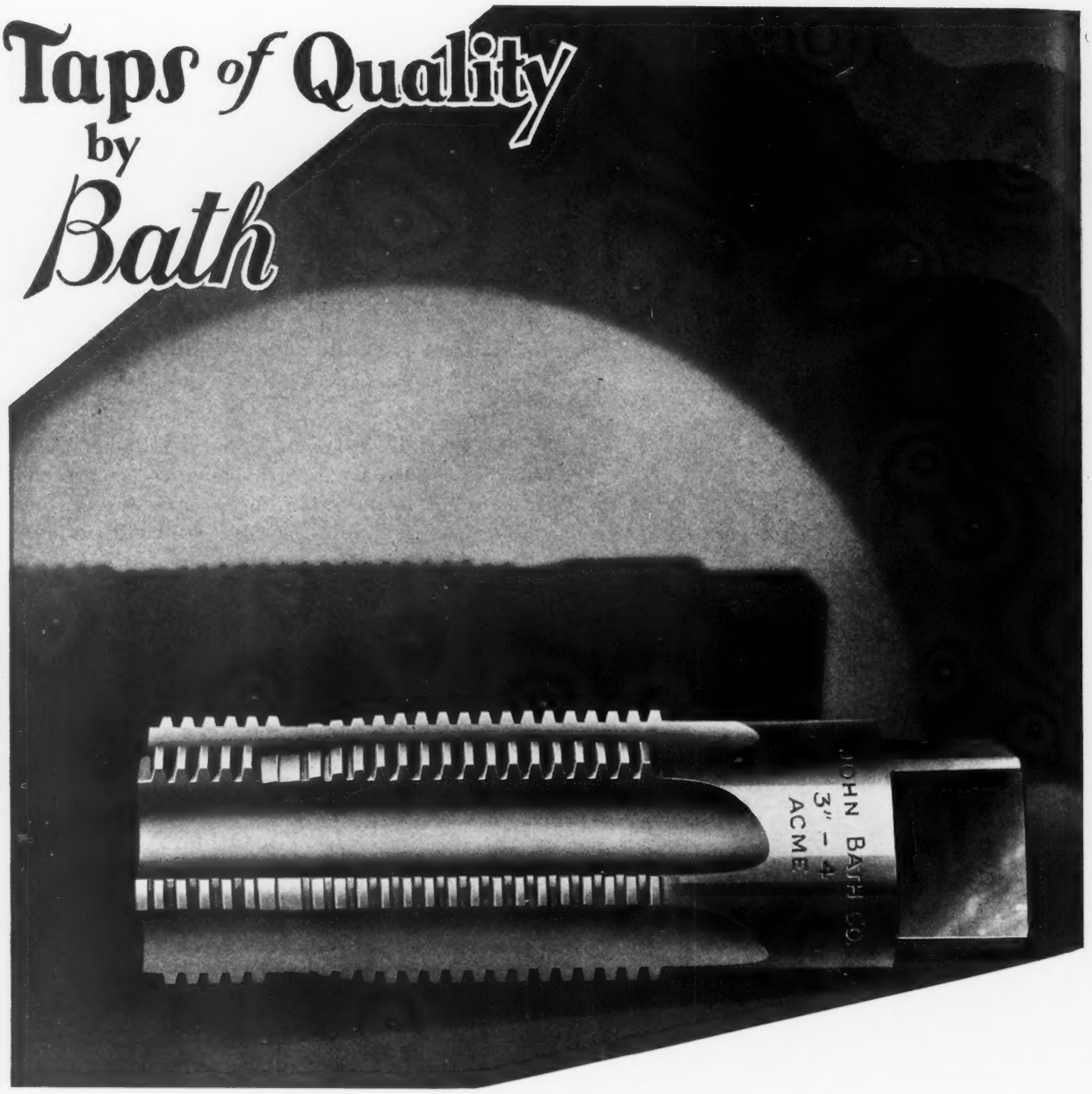
OILGEAR

THE PERFECT MACHINE FEED

Reg. U. S. OILGEAR Pat. Off.

(8220)

Taps of Quality by Bath



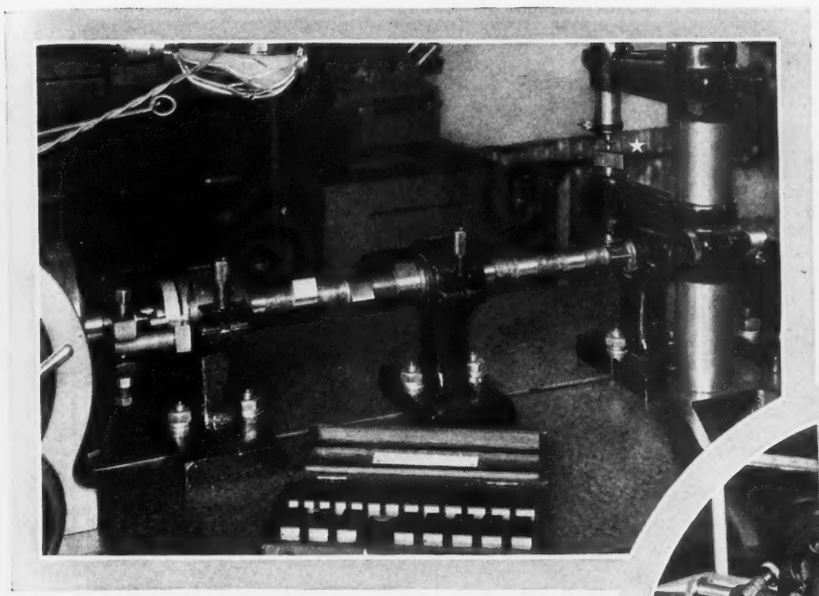
WE make a specialty of designing sets of acme thread ground taps for all kinds of jobs. Whether the nut to be tapped is long or short, the thread single or multiple, or the material cast iron, bronze or tough steel, Bath Engineers can recommend the most economical set of taps to do the work.

Results count:

1. **Accurate, smooth thread.**
2. **Minimum power required to drive taps.**
3. **Chips properly broken up.**
4. **Minimum of time consumed in tapping.**

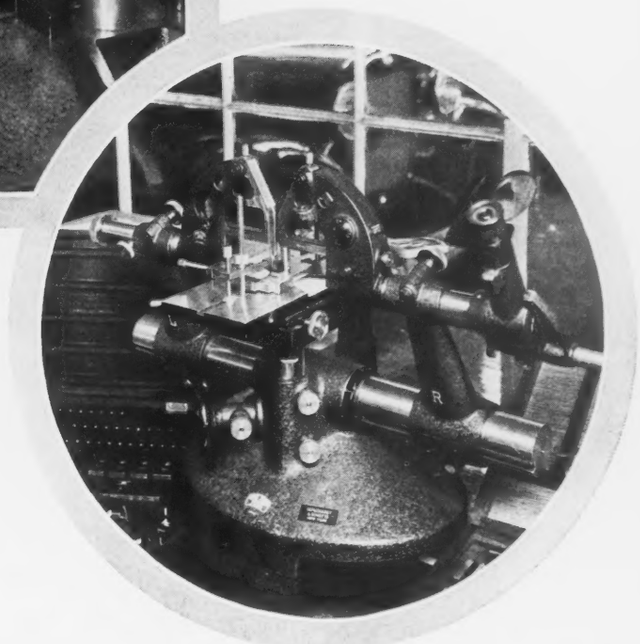
BATH TAPS are "GROUND from the SOLID" after HARDENING

JOHN BATH & CO. INC.
Worcester, Mass.



LEFT: *Setting master gage for checking cam shaft with Johansson Gage Blocks*

BELOW: *Setting inside optometer with Johansson Gage Blocks and Accessories*



Precision

that knows no parallel is yours with Johansson Gages!

MACHINE shop methods today demand a degree of accuracy considered impossible a few years ago. Highly specialized operators have replaced the "all-round" machinist. High-speed, quantity production has superseded the "cut-and-try system" that once prevailed. Specifications run to a few ten-thousandths of an inch, so that finished parts, machined in different departments, will fit in assembly. You can assure this accuracy in your products with a set of Johansson Gage Blocks.

These gage blocks of hardened and stabilized steel are "the world's standard of measurement"—used in the factories and government laboratories of every nation. By special processes, they are finished to accuracies of eight, four or two-millionths of an inch! This precision makes it possible to hold your gages and tools within their specified limits, eliminating the chance of costly errors in measurement.

When Johansson Gage Blocks are cleaned and slid together with a slight inward pressure, they take hold as though magnetized and handle like a solid block. A complete set of 81 gage blocks will build more than 120,000 different size gage block combinations in steps of one ten-thousandth of an inch. They are the most flexible, as well as the most accurate measuring tools ever devised. They may be applied directly—are virtually "fool-proof"—give the same results any number of times with different mechanics.

Checking a ring gage with Johansson Gage Blocks and Accessories

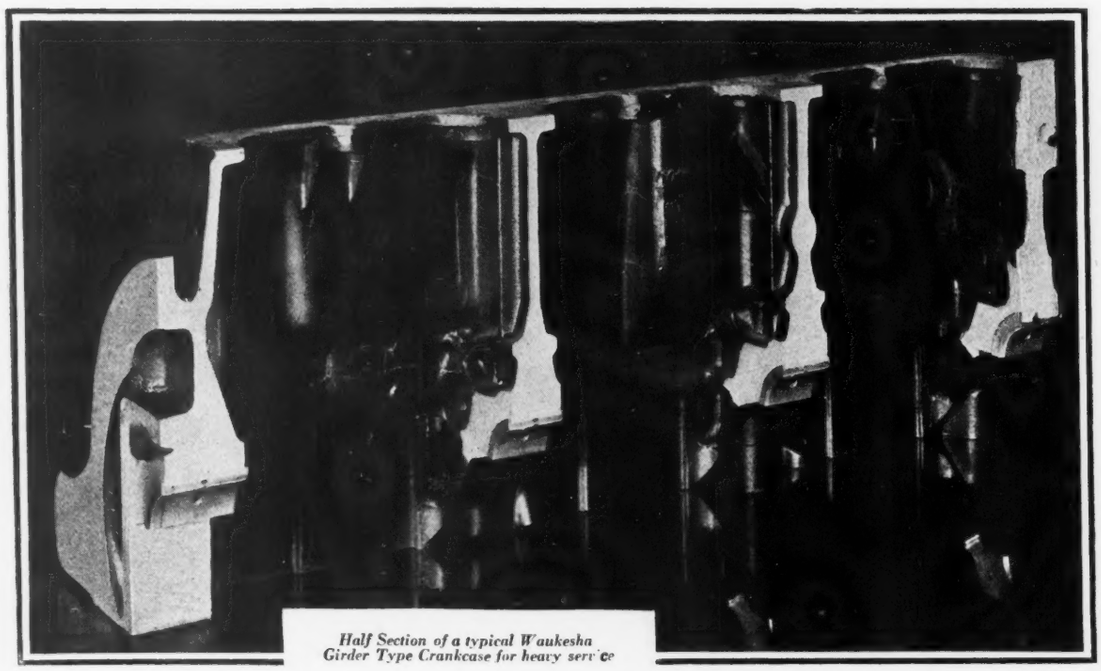
Johansson Gage Blocks are now available in commercial quantities at commercial prices because of the association of Mr. Johansson with the Ford Motor Company. There is a set designed to answer your own precision problems. List maximum and minimum dimensions of your product, together with your closest working limits.

C. E. JOHANSSON, *Inc.*

Division of **FORD MOTOR COMPANY**

Detroit, Michigan

Write direct, or to your Mill Supply Dealer

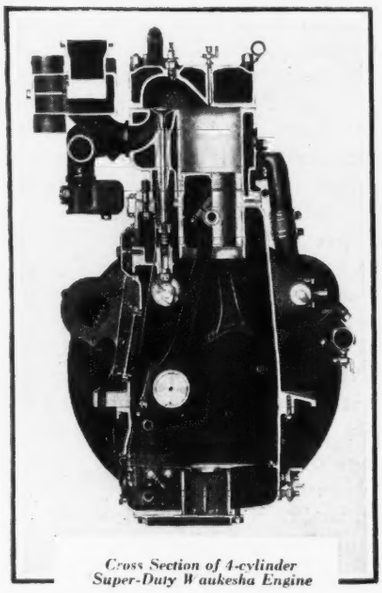


Half Section of a typical Waukesha Girder Type Crankcase for heavy service

A deeper crankcase ... for ... longer life

THE RIGIDITY of Waukesha Super-duty Engines does not depend entirely upon their overstrength crankshaft. The Waukesha patented "girder" type crankcase is also designed for extra rigidity—both in bending and torsion.

Waukesha's super-duty cylinders are held by flanges midway up on the barrel, making the crankcase six or eight inches deeper. Its ribbed cross walls are combined with wide bottom flanges. Behind the valve tappets, running the entire length of the engine, is an extra rib that helps tie the four cross walls together. This construction increases stiffness and rigidity tremendously. Maximum bearing life is thus assured, as well as extreme smoothness and freedom from destructive vibration. Bulletin No. 540 gives all details. Write to *Industrial Equipment Division, Waukesha Motor Company, Waukesha, Wisconsin, Offices: 8 West 40th Street, New York—7 Front Street, San Francisco.*



Cross Section of 4-cylinder Super-Duty Waukesha Engine

963

WAUKESHA ENGINES

SOMETHING NEW IN AUTOMATIC COMPENSATORS

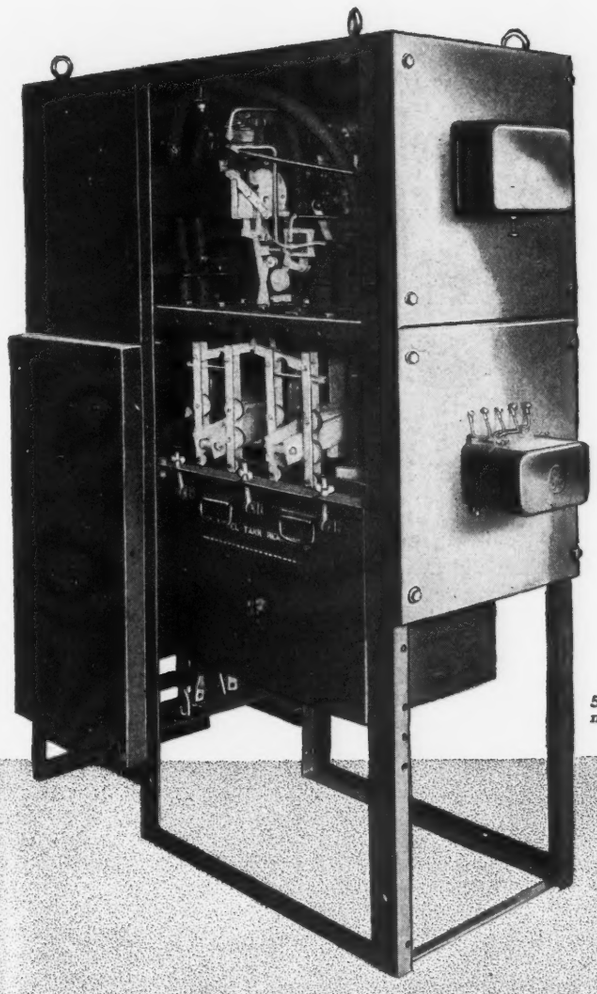
SAFER, and smaller—General Electric's new high-voltage automatic compensators are a big improvement over any other similar device on the market.

Safer—because of time-delay undervoltage protection. This built-in device prevents shut-downs due to momentary voltage fluctuations. It also keeps the contacts closed under accidental short circuits until 1½ seconds are allowed for the breakers ahead to clear the line.

Safer—because of improved double-break contacts with increased interrupting capacities.

Smaller—because of new, compact design.

Likewise, in various degrees, every automatic compensator in the G-E line has been greatly improved. Ask your nearest G-E office to tell you more about them.



500-hp., 2200-volt automatic compensator with side cover removed

Controllers
–guide and conserve industry's power

Invaluable to every control user. Have you a copy?

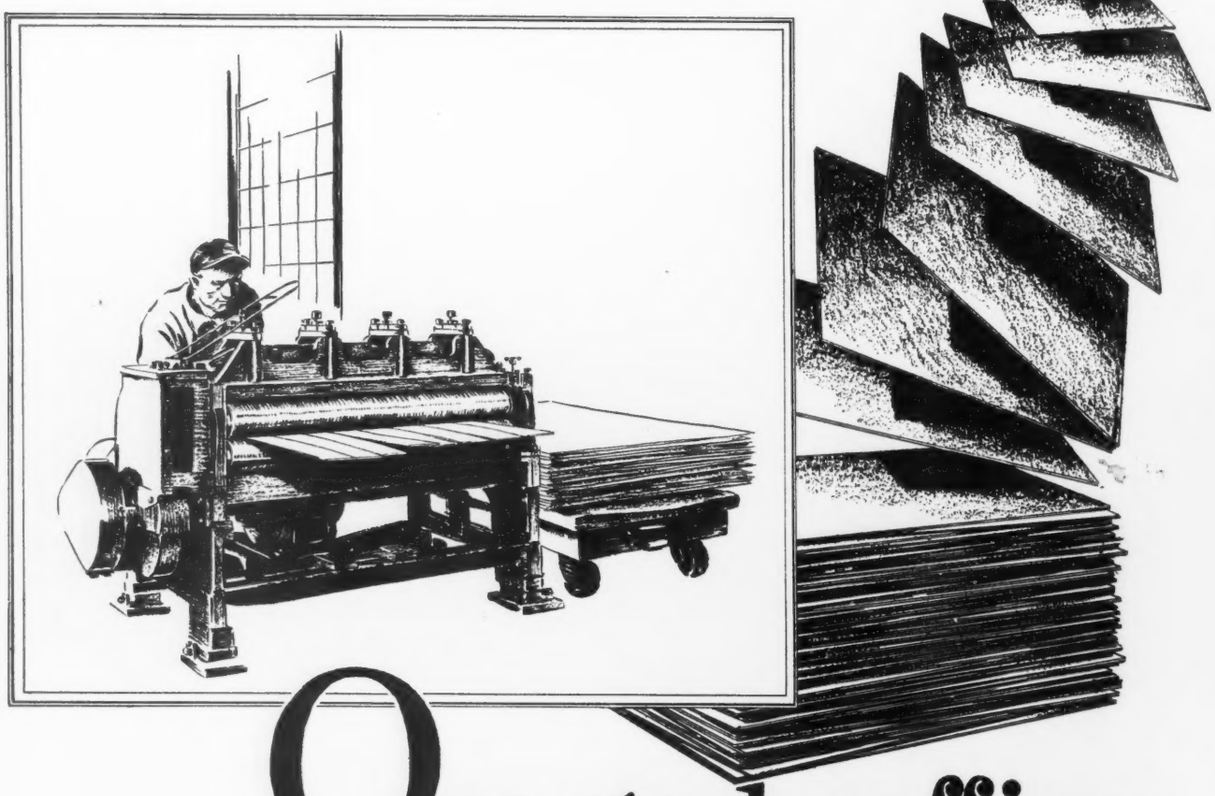
301-37

JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY SATURDAY AT 8 P.M., E.S.T. ON A NATION-WIDE N.B.C. NETWORK

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y. SALES OFFICES IN PRINCIPAL CITIES

When you buy in Sheets



One stock suffices

WHEN you purchase your metal in sheets and slit it in your own plant with the Putnam Rotary Gang Slitting Machine . . one stock of sheeting will do for practically any shape and size strip desired.

Thus, you can buy and stock sheets in large quantity and derive the benefit of big lot prices when the market for material is most attractive.

This Putnam machine (one of the Manning, Maxwell & Moore line of Lamb & Nash machines) cuts strips for you at far less cost than you would have to pay for ready-made strips. The machine costs little to buy, and cuts so true and clean that you can utilize your metal closer to the edge. It is saving costs in many plants throughout the country, shearing tin plate, hot mill sheets, blue annealed, all grades of cold rolled steels which come in hard, half-hard or dead soft, and brass, copper and aluminum.

Whether your plant is large or small . . you cannot afford to be without this cost-saving, true-cutting slitting machine. Let a Sales Engineer estimate the savings it will assure you.

Each cutter of the Putnam chair type Gang Slitter is held rigid by an individual support. Thus all stresses are transmitted to the frame of the machine. The arbors serve as rotating drives only. Hence clean, straight edges . . on every cut.

PLANERS
Open Side,
Double Housing

BORING MACHINES
MILLING MACHINES
DRILLING MACHINES

•

HEAVY DUTY
MACHINE TOOLS
For Industrial and Railroad
Shop Service

•

SPECIAL PURPOSE
MACHINES

Manufactured by
MANNING, MAXWELL & MOORE, INC.
at
PUTNAM MACHINE WORKS, FITCHBURG, MASS.

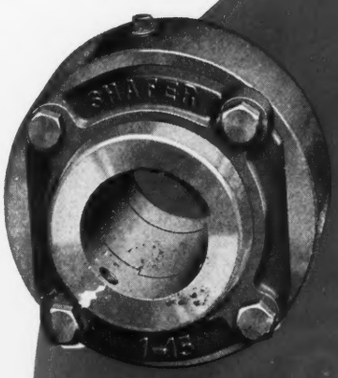
MANNING, MAXWELL & MOORE, Inc.

. . . . plus greater efficiency

To roller bearing load capacity and ball bearing operating characteristics, add the all-important principle of self-alignment. The result is a Shafer Bearing with its remarkably long-lived, wear-free efficiency.

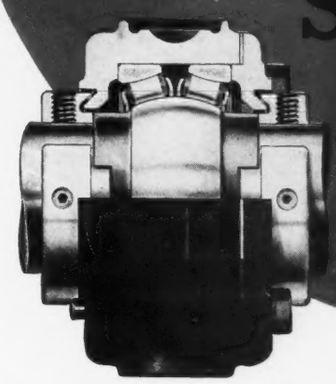
The Shafer Self-Aligning feature provides positive, automatic correction for the smallest deflection in shaft or housing and even under maximum loads there is no pinching or binding. Naturally, you can expect very worthwhile power economies from this smooth, free bearing action. Only the finest materials are used and Shafer workmen know their business. For complete freedom from bearing troubles install Shafer Self-Aligning Bearings in your plant equipment and products—you'll be amazed at their efficiency, longevity and economy.

Details on Request

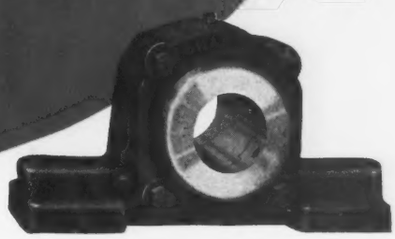


Shafer Self-Aligning Unit Mounting — a cylindrical housing fully machined. An ideal mounting for parts requiring frequent removals.

SHAFER BEARINGS are Self-Aligning



Shafer Hanger Bearings can be used with any 4-point hanger. Interchangeable with plain journal in most cases.



Shafer Pillow Blocks are compact, rugged and suitable for machine and general industrial equipment. Special housings can be furnished to meet individual requirements.

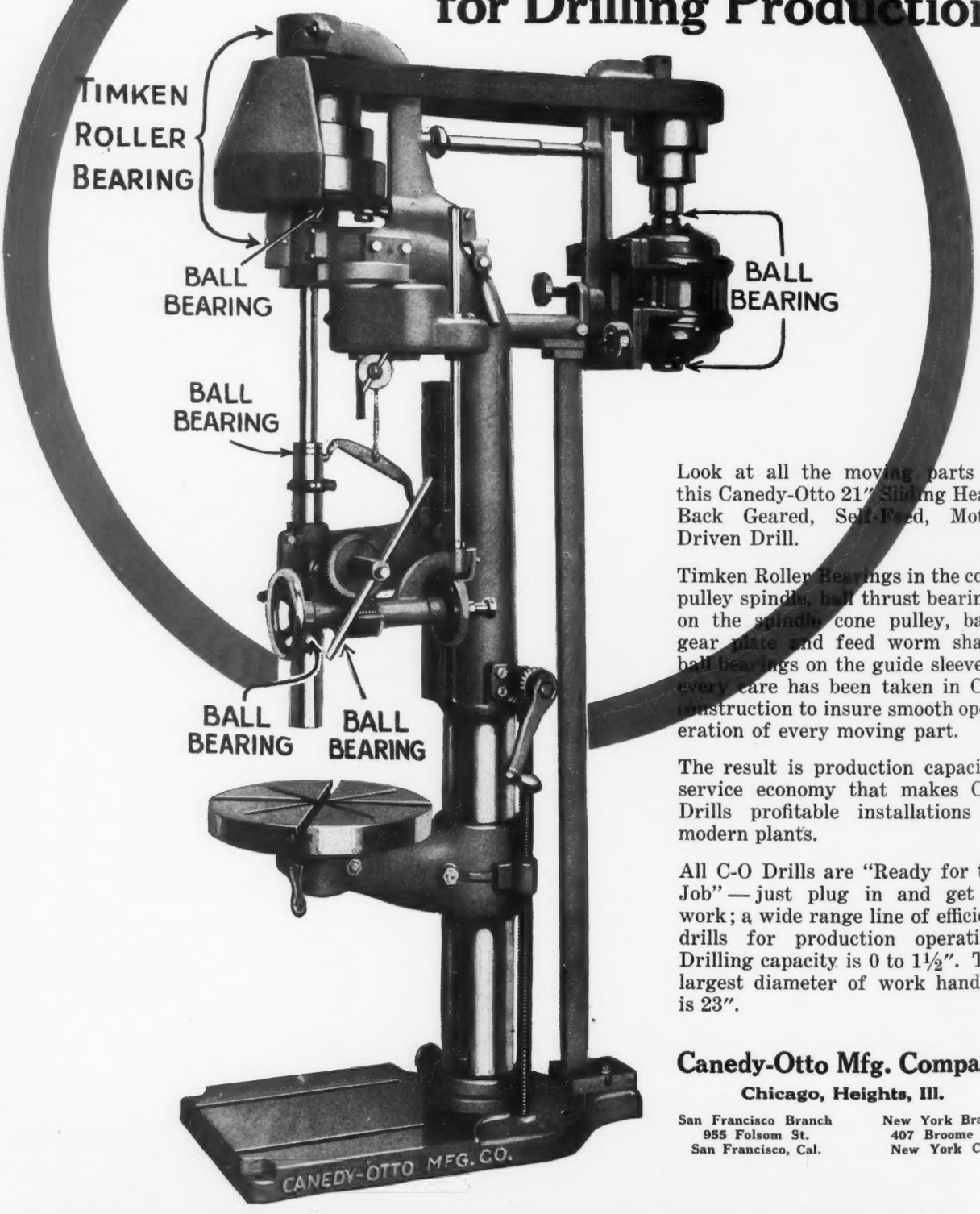
SHAFER BEARING CORPORATION, 6501-99 W. Grand Ave., Chicago, Ill.

Branch Stock: 173 Lafayette St., New York, N. Y.

SHAFER *Self-Aligning* ROLLER BEARING **INDUSTRIAL UNITS**

C-O DRILLS

Smooth Operation for Drilling Production



Look at all the moving parts in this Canedy-Otto 21" Sliding Head, Back Geared, Self-Feed, Motor Driven Drill.

Timken Roller Bearings in the cone pulley spindle, ball thrust bearings on the spindle cone pulley, back gear plate and feed worm shaft, ball bearings on the guide sleeve—every care has been taken in C-O construction to insure smooth operation of every moving part.

The result is production capacity, service economy that makes C-O Drills profitable installations in modern plants.

All C-O Drills are "Ready for the Job" — just plug in and get to work; a wide range line of efficient drills for production operation. Drilling capacity is 0 to 1½". The largest diameter of work handled is 23".

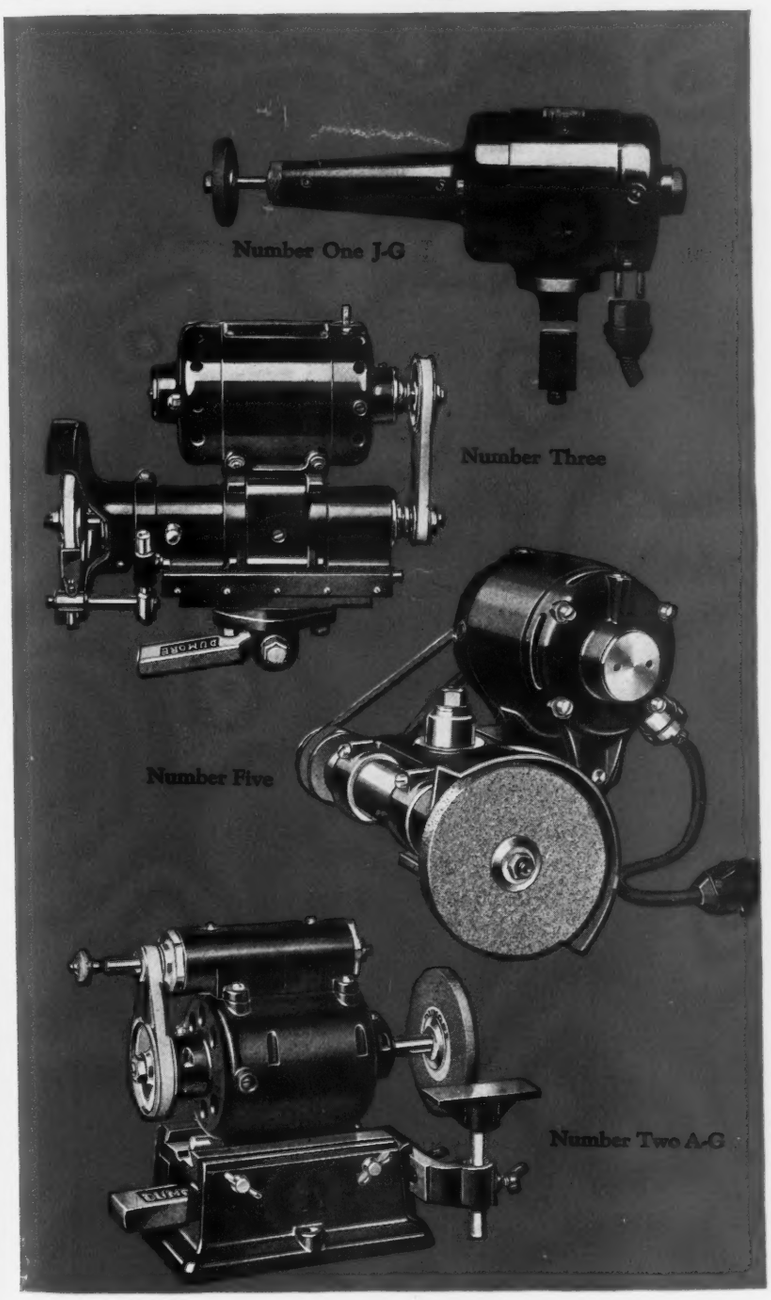
Canedy-Otto Mfg. Company

Chicago, Heights, Ill.

San Francisco Branch
955 Folsom St.
San Francisco, Cal.

New York Branch
407 Broome St.
New York City

This range of Grinders serves every grinding need .... *with*



Dumore Accuracy
down to .0001 inch

WHETHER it is a matter of grinding in the tool-room or for production ... there is in the Dumore line a *grinder that will best serve you.* This is not a boastful statement, but one which Dumore Grinder construction bears witness to.

Dumore Grinders have long been known for quality of construction and for their extreme accuracy down to .0001 of an inch. Naturally, they effect big economies by speeding up operations. In some plants they show such drastic cuts in production costs as 30 to 40 per cent. The ability of Dumore Grinders to meet the demand of high speed production in a wide range of uses has made them favorites.

Put any one of these Dumore Grinders to work ... be assured of long life, dynamic balance, smooth, vibrationless performance and *Dumore Accuracy.*

THE DUMORE COMPANY

25 Sixteenth Street Racine, Wisconsin

Send for Booklet

"Precision Grinding" is a highly technical treatise on various phases of grinding in the shop. Send for YOUR copy.

The Dumore Company
25 Sixteenth St., Racine, Wis.
Please send me "Precision Grinding", and tell me the allowance you will make on the grinder I now have.

Name_____

Address_____

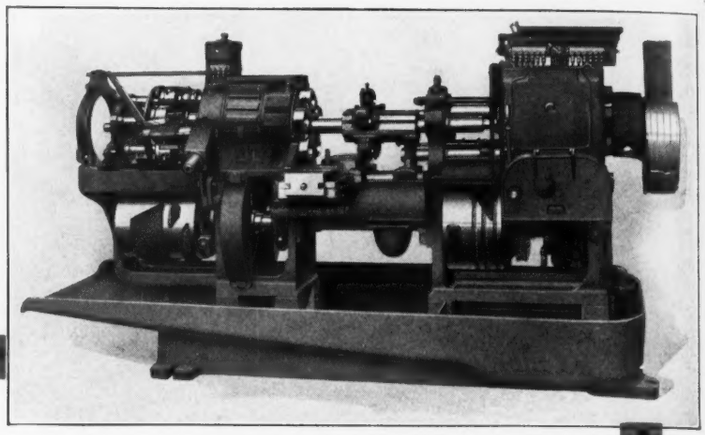
Make_____ Model_____

TRADE MARK

DUMORE HIGH-SPEED GRINDERS

REG. U. S. PAT. OFF.

Fast 5-Spindle Acmes will do your work BETTER!

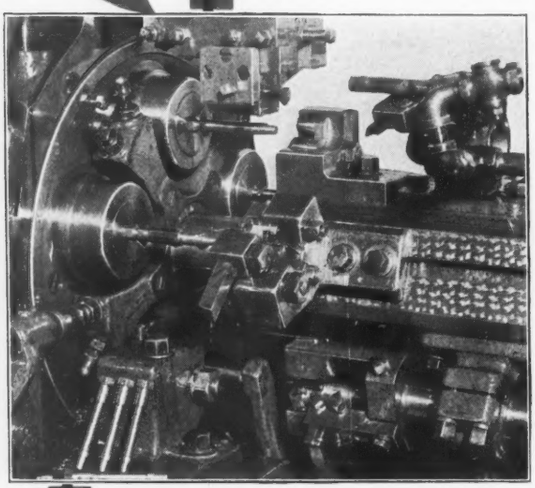


5-Spindle Acmes are built in 9/16", 1" and 1⅝" capacities
Belt Driven or Motorized

NAMCO

REG. U.S. PAT. OFF.

5-SPINDLE ACMES have a form of Turret, or main tool slide, which can *never* get out of line with the spindles. This Acme Turret is really an integral part of the Spindle Carrier assembly. It permits several sets of "close held" end working tools to be used in each one of the five productive turret positions.



5-SPINDLE ACME spindle spacing is accurate to a degree heretofore considered beyond attainment in production machine tool construction.

Send samples or blue prints of some of your tough jobs for guaranteed 5-Spindle Acme production figures.

The National Acme Company

CLEVELAND, OHIO — **WINDSOR, VERMONT**

NEW YORK — **DETROIT** — **CHICAGO**

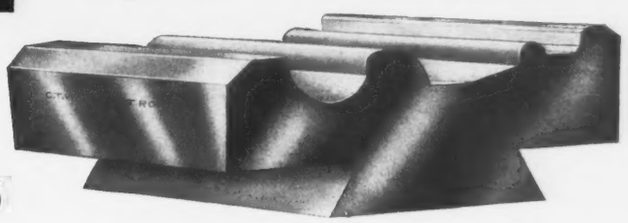
Agencies in Principal Foreign Countries

Perfect Form!

STEADFAST adherence to the highest standards of design and manufacture makes Continental Ground Form Tools as perfect as it is possible to produce.

Ground all over *after* hardening, Continentals never lose their original perfection; even after regrinds they continue to produce precision work with minimum waste of material. In their capacity for uninterrupted production work, you'll find Continental Form Tools a match for the highest speed automatic in your shop.

Manufacturing methods based on years of experience permit us to offer these ground-all-over tools at *unground prices.* It costs nothing to investigate—send the coupon below for full information.



CONTINENTAL
GROUND FORM TOOLS

and Continental Also Makes

Interchangeable counterbores and spot facers.
Milling cutters — inserted blade.
Taps—ground thread.
Milling cutters and keyway cutters — general line.

CONTINENTAL TOOLS

Continental Tool Works, Detroit, Mich.

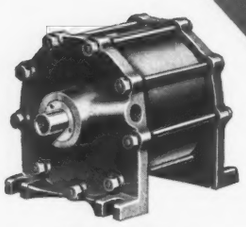
CONTINENTAL TOOL WORKS
Detroit, Mich.
Gentlemen:
Please send me a copy of your New Catalog.
Name .....
Address .....
Firm .....
Position .....

The New "LOGAN"

Non-Rotating Air Cylinders

SELF-ADJUSTED BY AIR PACKINGS
ELIMINATES ALL HAND ADJUSTMENTS

Model "A"

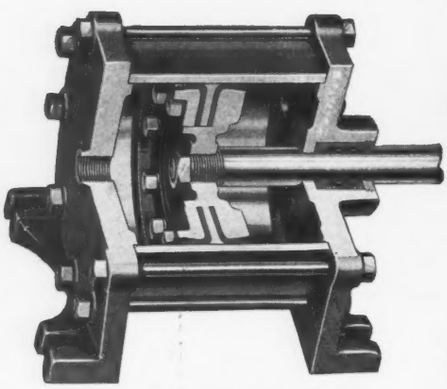


Model "B"

Model "E"

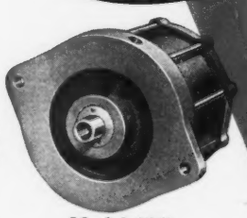
THE LOGANSPORT MACHINE CO.
"LOGAN"
AIR OPERATED
LOGANSPORT, INDIANA, U.S.A.

The self adjustment by air packings feature of the redesigned Logan line is one of our most important contributions to the cause of increased speed and convenience in work holding air devices. The elimination of all hand adjustments gives additional impetus to output on every job in which Logan equipment plays a part, increases efficiency and lowers production cost per unit. Other refinements of design assure gripping power that permits cuts and feeds of maximum limits at all times. For complete description and principal dimensions applying, send for circular No. 24.

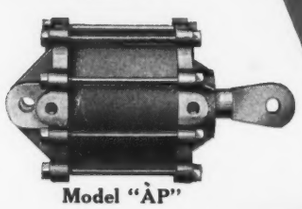


Sectional View the New Model "B" Cylinder

Showing the Self-Adjusted by Air Packings as used in all models "LOGAN" Double Acting Air Cylinders.

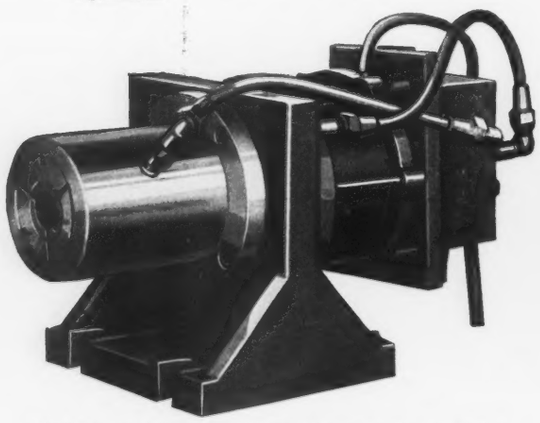


Model "F"

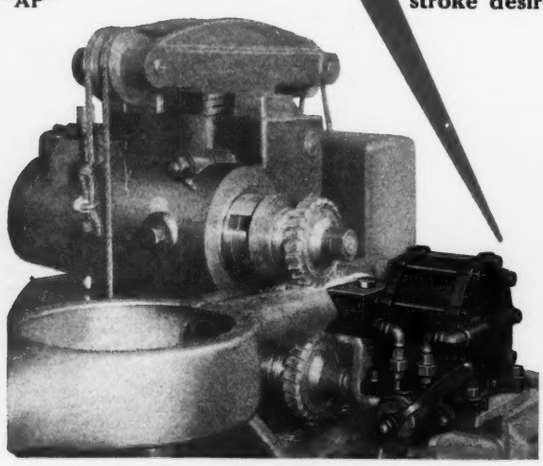


Model "AP"

Five standard models of size 1½" to 16" diameter of bore. Any stroke desired.



Special Air Operated Work Holding Device including Model "A" Non-Rotating Cylinder, standard Collet Chuck and Model "G" Foot Valve arranged for Automatic Control with Exhaust air being used for ejecting work.



"Logan" Model "B" Non-Rotating Cylinder

Adapted to work holding fixture on the Sundstrand Machine Tool Co.'s Rigidmil.

Production On This Piece Increased 70%

The part illustrated is a Shaft Hub for Marco Vernier Shaft Dials made by the Martin Copeland Company. Threads are $\frac{3}{8}$" diameter, 32 pitch and $\frac{1}{4}$" long.

Production was 2700 Hubs per day; the adoption of Geometric Style DS Die Heads raised this figure to 4600—a 70% increase!

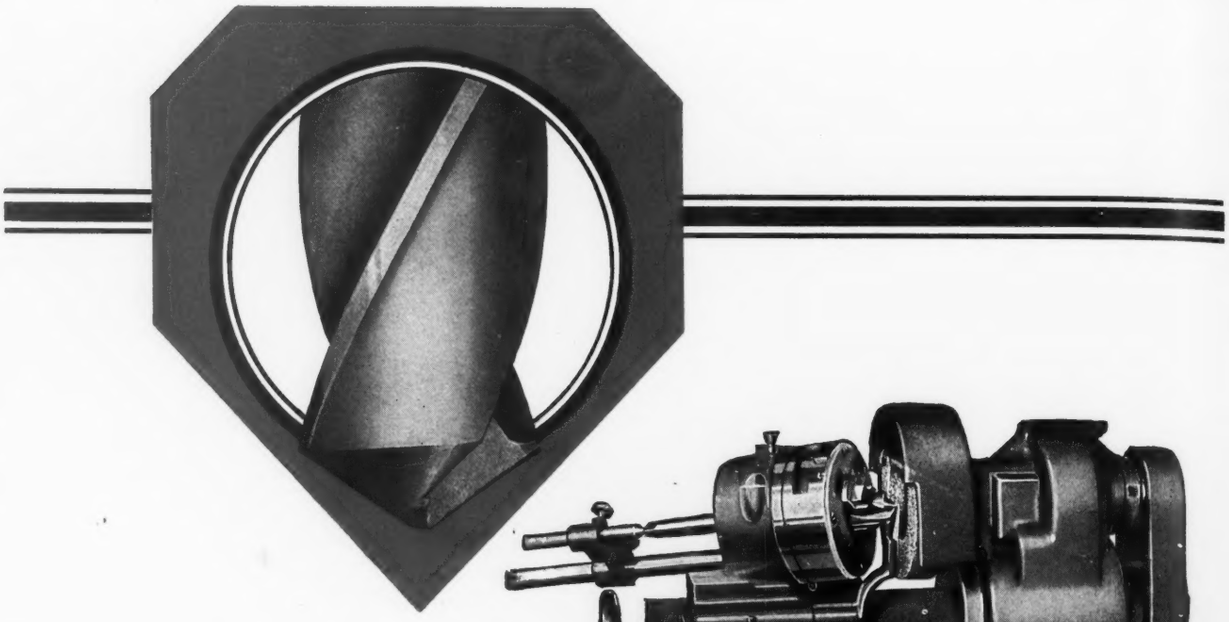
Such cost reduction is characteristic of Geometric Die Heads.

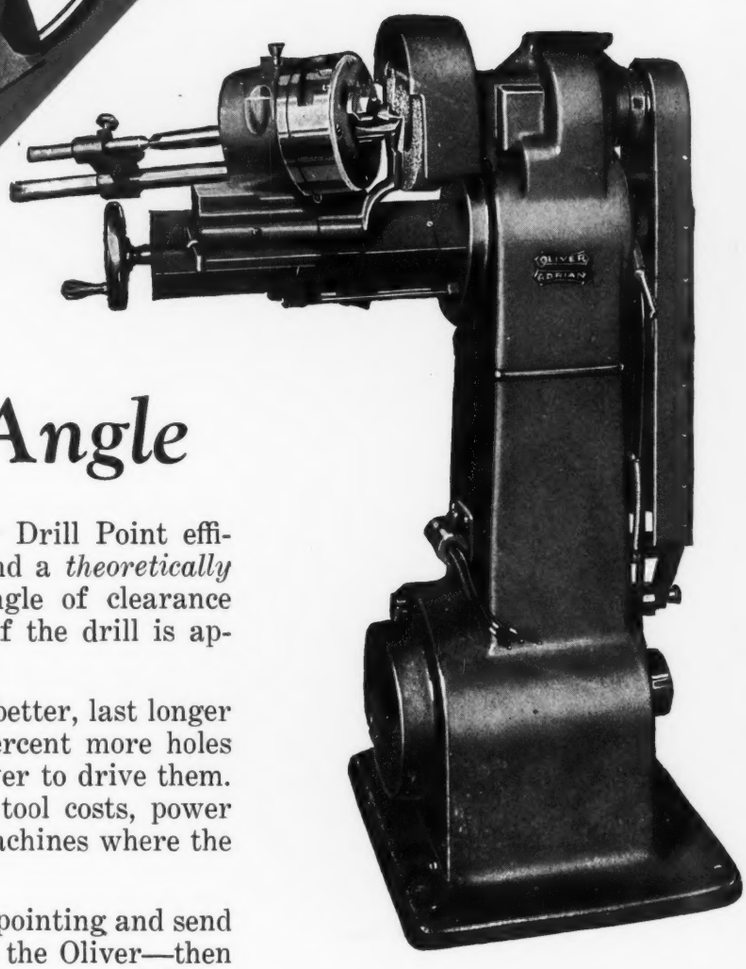
THE GEOMETRIC TOOL COMPANY

(Westville Sta.) New Haven, Conn., U. S. A.

Also manufacturers, for more than 30 years, of the well-known Geometric Line of Threading Machines and Collapsing Taps. If it can be threaded, Geometric has the tool to do it.

GEOMETRIC
STYLE DS
DIE HEAD





Ground to the Correct Angle

Herein lies the secret of Oliver Drill Point efficiency. Oliver Drillpointers grind a *theoretically correct drill point* with the angle of clearance increasing rapidly as the web of the drill is approached.

Correctly pointed, the drills cut better, last longer (producing from 100 to 500 percent more holes per grind) and it takes less power to drive them. All of which naturally reduces tool costs, power consumption and wear on the machines where the Oliver Drillpointer is used.

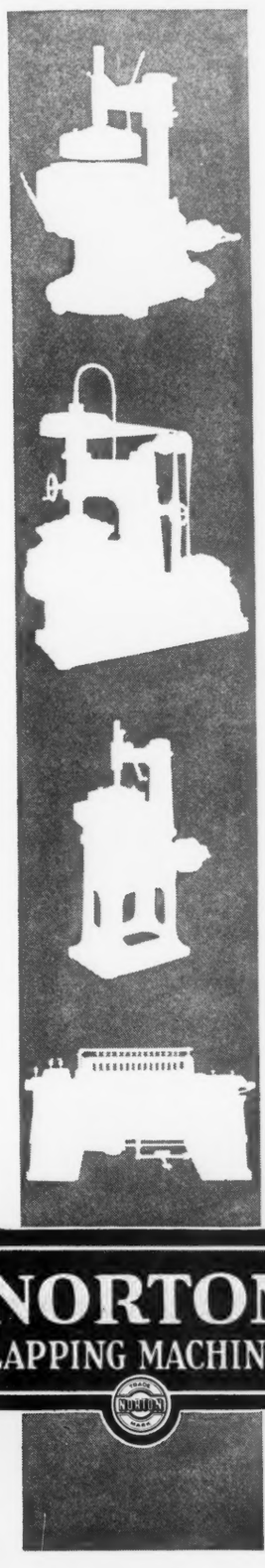
Pack up a few drills that need repointing and send them in to us for regrinding on the Oliver—then try them out and note the difference in drilling results. *Send for Bulletin.*

OLIVER INSTRUMENT COMPANY

1410 E. Maumee Street ADRIAN, MICH., U. S. A.

OLIVER DRILL POINTS

Commercial LAPPING—



What is Lapping?

Lapping is a process for refining parts to the highest obtainable degree of accuracy for roundness or parallelism and surface.

What are its advantages?

Lapped surfaces provide a higher percentage of bearing area and allow a more uniform distribution of the oil film. Consequently lapped working parts, particularly those under great stress, will wear longer without reduction in size. Also there will be less risk of seizure, less slack, less noise and longer life.

Is Lapping practical on a modern production basis?

Yes. Lapping is no longer a hand or semi-hand process—slow, expensive and commercially impractical so far as mass production is concerned. It is now possible to obtain easily, uniformly and economically the perfection which it has been known for years that lapping could give. The development of Norton Lapping Machines has brought the accuracy of the lapping process at an economical production rate.

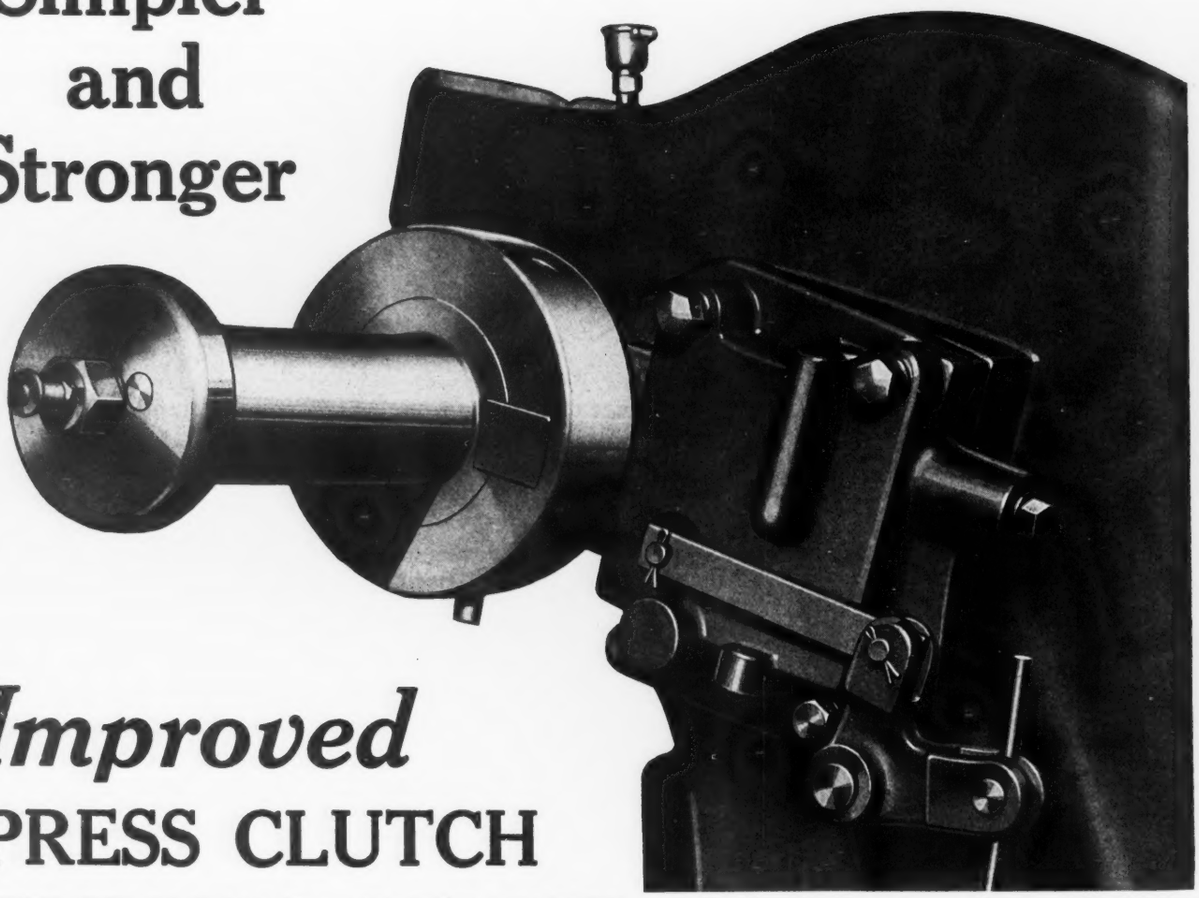
There are Norton machines for lapping flat work, cylindrical work and crankshafts. Let us tell you what they can do on your work that requires extreme accuracy and high finish.

NORTON
LAPPING MACHINES

NORTON COMPANY, WORCESTER, MASS.
New York Chicago Detroit Philadelphia
Pittsburgh Hartford Cleveland Syracuse

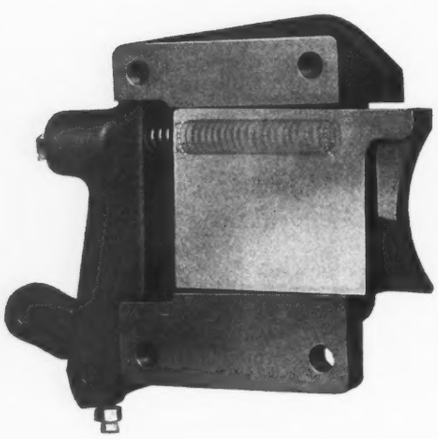
L-17

Simpler and Stronger



Improved PRESS CLUTCH TRIPPING DEVICE

Patent Applied For



THE new clutch trip and bracket combines fewer parts of more rugged construction, resulting in greater resistance to the wear and tear of operation.

Bracket is one-piece construction, encasing all parts except connecting link which is accessible and allows for visible limit stop.

A wider throwout provides a longer drift for shaft; a deeper seated stop for the clutch pin results in wider and thicker backing for its action; the single long spring is inspected or replaced by removing screw plug. Single stroke attachment furnished on special order.

NIAGARA MACHINE & TOOL WORKS

637-697 Northland Ave. Buffalo, N. Y.

Philadelphia Elverson Bldg. | Pittsburgh Park Bldg. | New York City 50 Church St.

Write for Bulletin No. 58 describing Niagara Inclinable Presses with the new type clutch.

NIAGARA

An Important Link in the Production Chain

Two hundred strokes a minute, twelve hundred per hour, hours on end and day after day, stamping out links for silent chain—this Henry & Wright Dieing Machine is in itself an important link in the production chain at the plant of a well known chain manufacturer.

Automatic feed rolls—easily adjusted for any job—feed the work at a steady pace. Design and construction that practically obviate vibration permit high speed operation.

Permanently correct alignment insures maximum life to punches and dies in constant service. Henry & Wright Dieing Machines can always be counted on to take important places in production schedules. A Nielsen Survey giving detailed data of performances in nationally known shops is highly interesting.

HENRY & WRIGHT MANUFACTURING CO.
Hartford, Connecticut

HENRY & WRIGHT DIEING MACHINE

Is There a Short-Cut to Increased Profits?

Die Grinding with HASKINS Equipment enables the die maker to work with ease and great speed.

Legend tells us of the magical road to fame and riches. Many a factory executive in pondering over ways and means for cutting "overhead" has sought—and sought in vain—for this magical road.

But there is a way to boost profits. A reduction in labor costs will do it. So will increased output. So, too, equipment that brings about workmanship of higher and finer standards—that frees men from much that was irksome, time-wasting hand drudgery.

These things are possible with HASKINS Flexible Shaft Equipment. "Overhead" is reduced because larger production is attained with no increase in man-power. And the logical sequence to this is increased profit.

The name HASKINS needs no introduction to you. But if it does not appear on tools in use in your plant you may be overlooking opportunities for saving and earning that will look mighty good when the periodical profit sheet is run off.

Taking the tool to the work instead of the work to the tool means much in labor saving.

HASKINS Equipments are cutting costs in the big automobile plants —grinding, sanding and polishing.

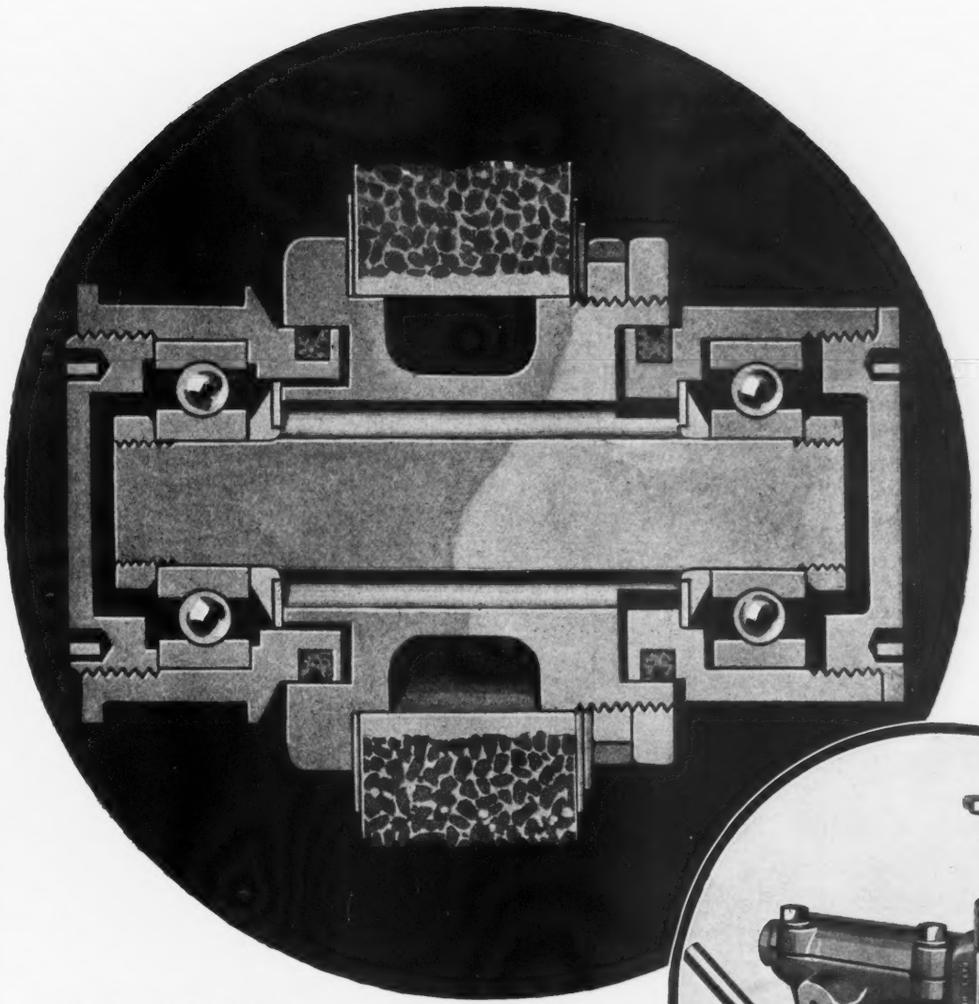
Model D B-6, one of the many types of Haskins Flexible Shaft Equipment.

An invitation is extended to open-minded executives to investigate the possibilities of HASKINS Equipment. As a prelude to this, send for complete descriptive catalog.

R.G.HASKINS COMPANY
Portable Flexible Shaft Machinery

4634 W. FULTON ST.
CHICAGO, ILL.

Branch Offices in Principal Cities



The Ross "Senior" Hub—Five Times More Bearing Life

In this new hub the *inner*, instead of the outer, races turn—decreasing ball speed 40%. Larger balls and bearings, in hardened tool steel cages, give 60% more load capacity. Distance between bearings is doubled. Bearings are the closed, springless type, avoiding initial loads and binding. Right bearing "floats", eliminating internal strains. Hub axle is one piece. Four ring-washers, *outside* the bearing cages, seal the tool against grit and water.

"Senior" wheels are replaced without disturbing the bearing assembly. Hub and wheel are removed by simply unscrewing four hollow-head nuts. Two steady-rest screws give 3-point support, permit tilting of wheel to any shearing angle, and eliminate vibration. Holder-head and bracket are heat-treated aluminum alloy, stronger than cast-iron and one-third its weight.

A truing tool is no finer than its hub

THE greater economies of the mechanical type wheel-truing tool and the accuracy of its work depend more upon its bearing assembly than on any other factor. Ross engineers have always recognized this fact in their development of finer mechanical dressers. Into the Ross "Senior" they have built a radically new hub that not only averages five times the life of the best previous designs but that insures a quality standard for finish grinding work never possible heretofore. A glance at the enlarged cross-sectional view of the "Senior" hub, above, tells any practical grinding man why this is so—and why the "Senior" is revolutionizing cylindrical wheel-truing costs in the country's largest grinding shops.

THE ROSS MANUFACTURING CO., Cleveland, Ohio

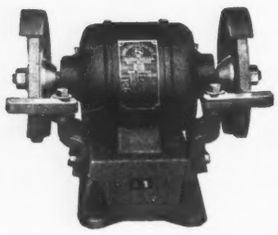
Ross

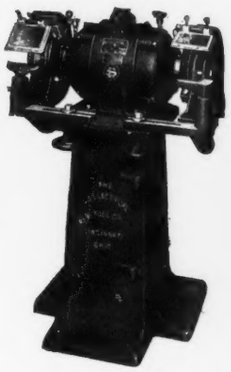
ROSS SENIOR

EMERY-WHEEL TRUING TOOL

DEPENDABLE Grinders

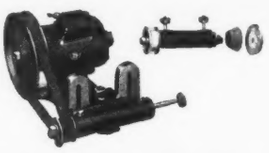
The downright dependability of U. S. grinders under long, heavy service—their consistent economy—and their advanced features naturally have made them the standard of quality ever since U. S. brought out the world's first electric grinder. Ask your jobber or write us for catalog on the complete line—here are just a few numbers—and include U. S. figures in your estimates.





U. S. 6″, 7″, 8″, 10″ Grinders

Ideal for grinding edged tools and for heavy duty general purpose work within their rated capacities. Furnished for bench or pedestal in ¼, 1/3, ½ H.P., 3,450 R.P.M. and 1 H.P., 1,750 R.P.M. Ball Bearings.



U. S. Tool Post Grinders

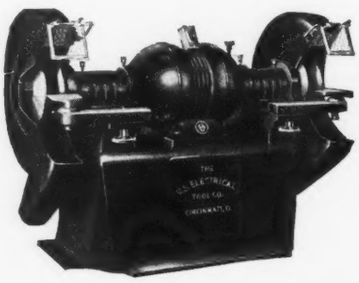
The U. S. line covers a broad range of tool post, angle plate, center and similar grinders for surface, internal and external use on lathes, shapers, planers, etc.

U. S. 12″ to 20″ Grinders

Popular for continuous, heavy duty service at full load in 12″, 14″, 16″, 18″ and 20″ wheels. Same high grade spindle, bearings and other equipment as on heavier grinders.

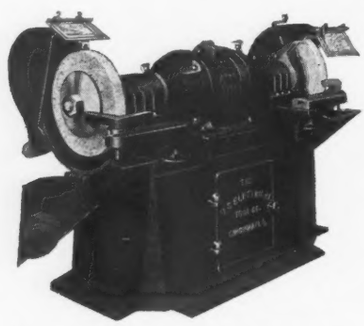
U. S. Combination Grinders

For use on lathes, planers, boring mills and shapers for internal and external grinding. Furnished in ¼, ½, 1 and 2 H.P., R.P.M. (external), 18,000 to 7,500 R.P.M. (internal.)



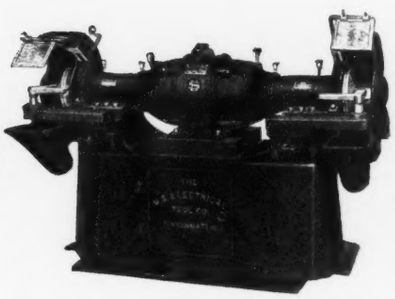
U. S. Portable Surface Grinder

The U. S. line includes many types in 4″, 5″, 6″, 8″ sizes. All with SKF Ball Bearings.



U. S. Hi-speed Snaggers

Designed and built for use with 20″ and 30″ high speed wheels running at 10,000 surface feet per minute. Average speed 9,300 s. f. p. m. Four heavy duty SKF Ball Bearings, chrome-manganese alloy steel spindle, etc.



U. S. Heavy Duty Grinders

Designed and built to withstand continuous production service under most severe conditions. Chrome-manganese alloy steel spindle, 4 heavy duty SKF Ball Bearings, etc. Furnished in 16″, 18″, 20″, 24″ and 30″ sizes.

U. S. Adjustable Speed Heavy Duty Grinders

Maintain a constant peripheral speed of approximately 5,500 feet per minute regardless of wheel wear. Made for 18″, 24″, 30″ wheels. Bearings and other equipment same as other U. S. grinders.

THE STANDARD OF QUALITY SINCE 1897

THE UNITED STATES ELECTRICAL TOOL COMPANY

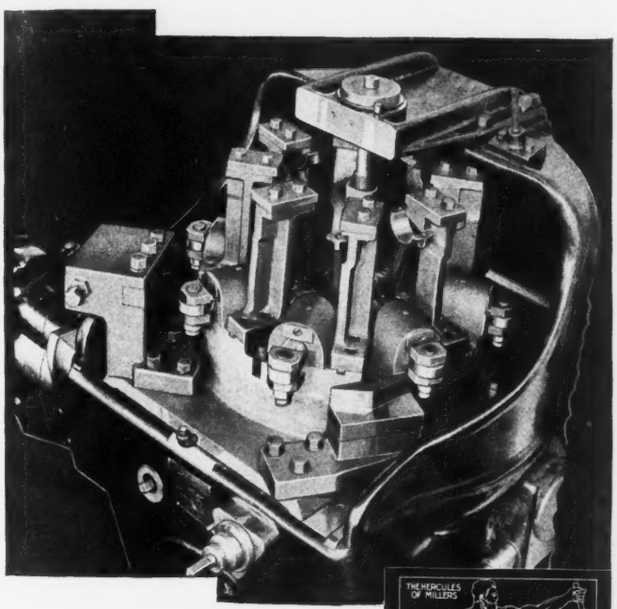
Oldest Builders of Electric Drills and Grinders in the World

2477 West Sixth Street — Cincinnati, Ohio, U. S. A.

Atlanta	Cleveland	London	Philadelphia	Syracuse
Boston	Dallas	Minneapolis	Pittsburgh	Toronto
Chicago	Denver	New York	St. Louis	Winnipeg
	Detroit		San Francisco	

Export Sales Representatives—WESTINGHOUSE ELECTRIC INTERNATIONAL CO.—150 Broadway, New York City

Milling and Slotting a Connecting Rod — *Every Six Seconds*



THIS 28″ Offset Miller runs 24 hours a day in one of the world's largest automobile factories. It turns out connecting rods at the rate of approximately 585 per hour (less the down time necessary for changing cutter set-up, etc.).

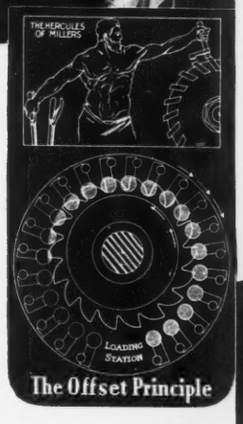
Executives whose job it is to move production lines on schedule will find it profitable to carefully consider the advantages secured on this job by offset milling: Multiplied production, reduced cost per piece, lowered labor cost, smoother finish, lengthened interval between grinds, one machine does the work of several ordinary millers, conserves valuable floor space.

The field of offset milling is constantly widening as our engineers find solutions to production problems. This revolutionary type of milling includes straddle milling, face milling, milling to length, slotting, milling radii from 4 to 12 inches and form milling where radius is not objectionable. Parts made of bars, tubes, castings or stampings can be handled economically.

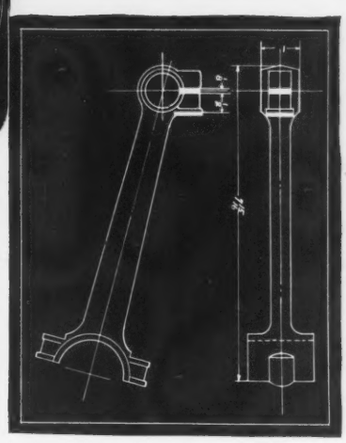
The Offset Principle

THE cutter spindle is offset from center of work table a distance equal to depth of cut to be made. A large cutter is used, revolving in the direction opposite to which table is turning. This set-up makes it possible for 90 degrees of the cutter to be in the cutting field at all times. The application of this principle is limited, on all but the heaviest jobs, by the ability of the operator in feeding the machine.

Write for Offset Miller Catalog



The Offset Principle



The Job

Part—Automobile connecting rod.

Operation—Slotting and milling bolt boss in one operation.

Production—585 pieces per hour.

Equipment—28″ Offset Miller. Eight unit work-holding fixture — automatic clamping and unclamping.

Cutters—One 6″ half side milling cutter and one 6″ slitting saw.

THE OESTERLEIN MACHINE CO., CINCINNATI, OHIO, U. S. A.

OESTERLEIN OHIO
MILLING GRINDING DRILLING
EQUIPMENT

Fast broaching, this!

HOUDAILLE Hydraulic Shock Absorbers are widely famed for their precision requirements. Famed most, perhaps, because the accuracy they demand must be obtained under huge volume production.

Oilgear Broaching Machines, thus, found in the Houdaille shops a real test of merit. For example, they finish to size the radii on wings and wingshafts at the rate of 400 pieces per hour, per machine . . . often running from ten days to two weeks without resharpening tools. And Houdaille says, "The use of these machines has permitted us to hold the parts to even closer limits than was possible when we used milling machines for this operation."

For these REASONS

Steplessly adjustable to any speed from maximum to zero. Straight-line application of power without waste . . . steady, chatterless. Simple design . . . trouble-free. Efficient. Economical.

Why? How? Hydraulic broaching! The speed of Oilgear Broaching Machines is limited only by the maximum ability of the operator to serve them. That means high production. Because of the smooth, positive hydraulic power, there is no chatter, no vibration. That means better, more accurate work, freedom from tool breakage, and less frequent sharpening.

If you have a production operation that should be done by broaching or is now being done by broaching, it will pay you to investigate Oilgear Broaching Machines. Write, today, for Bulletins 2000 and 2001. THE OILGEAR COMPANY, 667 PARK STREET, MILWAUKEE, WISCONSIN.

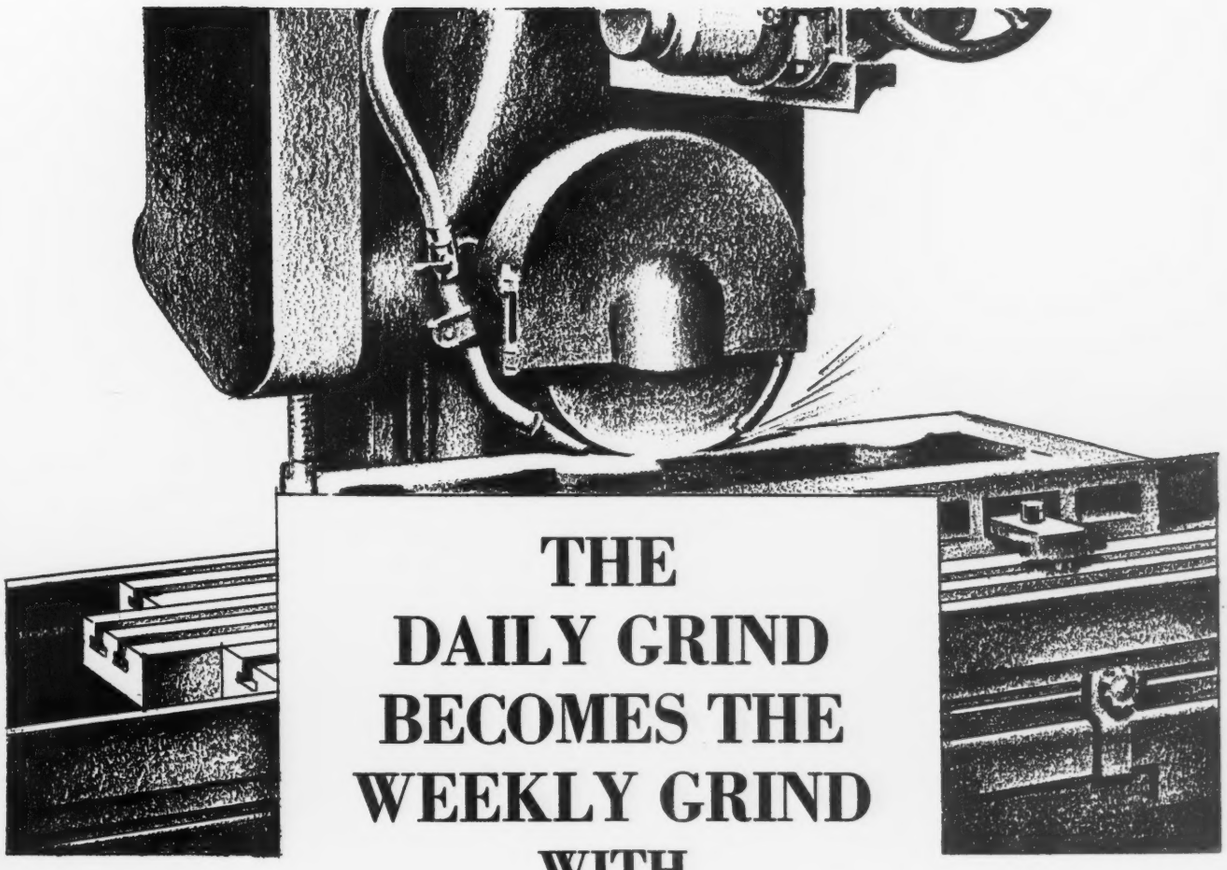
OILGEAR

BROACHING MACHINES • PRESSES
PUMPS • FEEDS • TRANSMISSIONS

OILGEAR

Reg.U.S. Pat. Off.

(8211)



THE DAILY GRIND BECOMES THE WEEKLY GRIND WITH CROMOVAN

HISS of grinding wheel against steel . . . An expensive die one grind nearer the scrap heap . . . Unpleasant music to the Cost Department . . . An idle press . . . Perhaps idle men along the assembly line, waiting for material.

Can't stop a press, remove a dull die, grind it, reset the die and resume production—without having it show on the cost sheet.

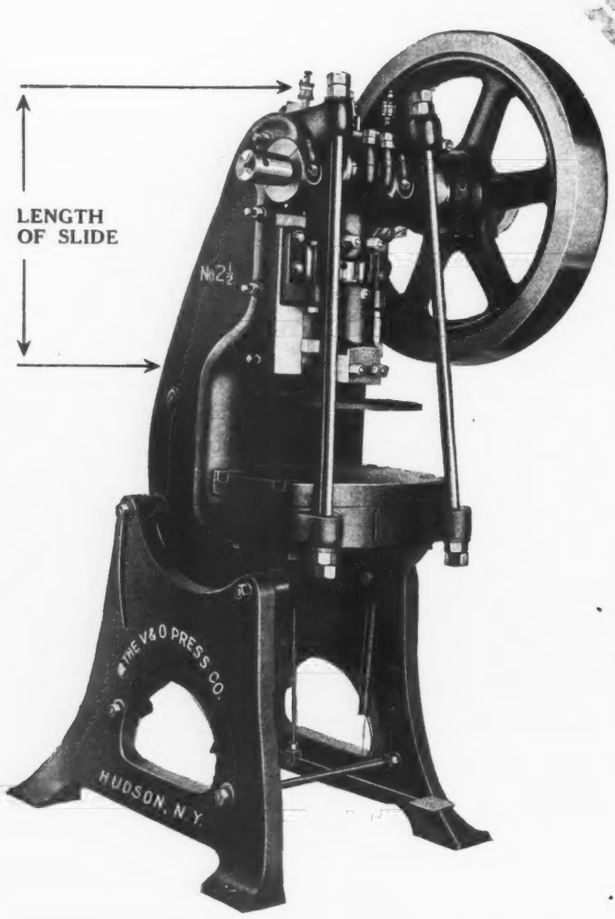
CROMOVAN TRIPLE DIE STEEL gives 8 to 10 times the output of standard die steels between regrinds . . . CROMOVAN is easy to machine in the annealed state . . . CROMOVAN holds its shape well during hardening . . . CROMOVAN hardens deeply in heat treatment.

CROMOVAN is THE steel for better dies.

FIRTH-STERLING STEEL COMPANY

WORKS: McKEESPORT, PA.
GLOBE WIRE DIVISION
SHARPSBURG, PA.
NEW YORK DETROIT
BOSTON CLEVELAND
PHILADELPHIA CHICAGO
HARTFORD LOS ANGELES

Safe!



With a "Long Slide"

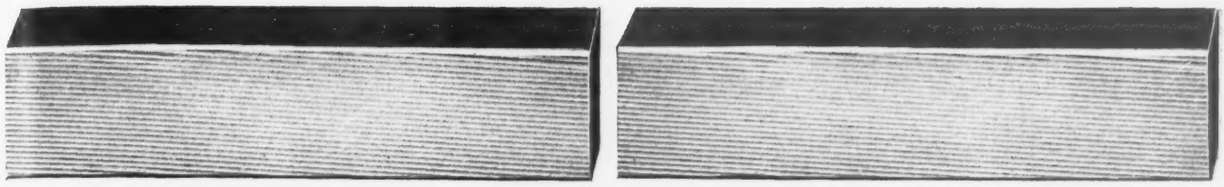
Baseball has no more colorful play than the stolen base. The runner's scurrying start, the catcher's line throw, the ball and runner arriving at the bag simultaneously, the baseman's catch and lunge to make the put-out, the desperate slide in a cloud of dust—it's a good play if the slide is right!

The slide is mighty important in a press, too, and the V & O "Long Slide" principle is the safe one. In the Inclinables, particularly, it is practically twice as long as that generally employed, the bearing length never being more than two or three inches short of the full length of the ways even with maximum stroke. This results in greater perfection of travel, higher accuracy and longer die life on every operation.

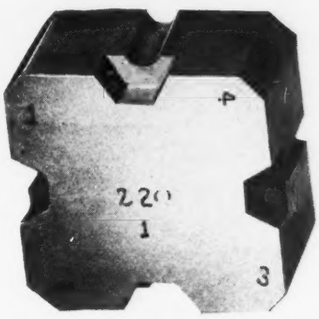
The "Long Slide" is just one of many important features of design and construction that enable V & O Presses to show increased production and greater profits on every kind of press work. We have a new catalog awaiting your inquiry.

THE V & O PRESS CO.
HUDSON, N. Y.

V&O "Long Slide" PRESSES



HUMP-Hardened Dies
Pass Every Test

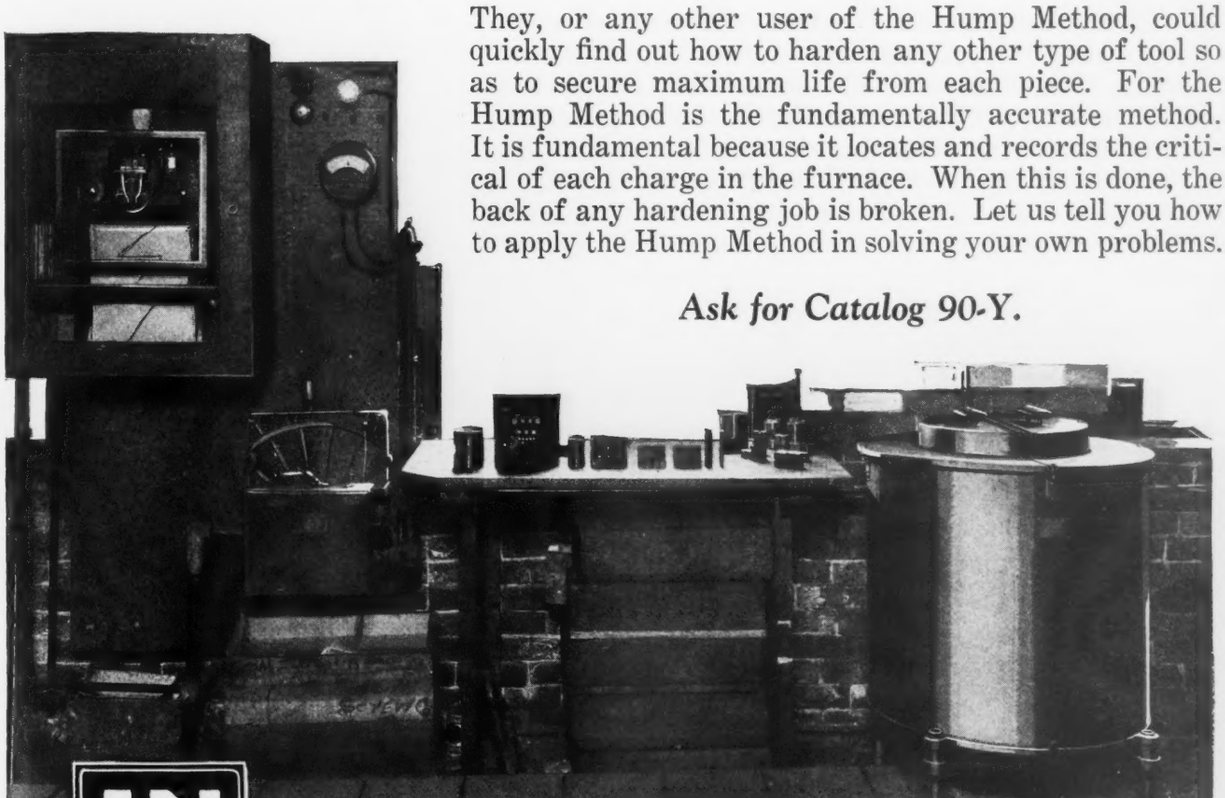


MODERN, high-output manufacture of screws and bolts is a smashing, grinding ordeal for dies. It tests them in every detail—including the hardening. The fact that many bolt and nut makers use the Hump Method for hardening these dies is a striking proof of how successful the method is.

The Corbin Screw Corporation, for instance, uses this Hump installation on heading and thread-rolling dies. They can tell—in advance—that every die (of the split type) will last for about 2,400,000 pieces — 600,000 pieces per face. They know that other dies will have correspondingly long life.

They, or any other user of the Hump Method, could quickly find out how to harden any other type of tool so as to secure maximum life from each piece. For the Hump Method is the fundamentally accurate method. It is fundamental because it locates and records the critical of each charge in the furnace. When this is done, the back of any hardening job is broken. Let us tell you how to apply the Hump Method in solving your own problems.

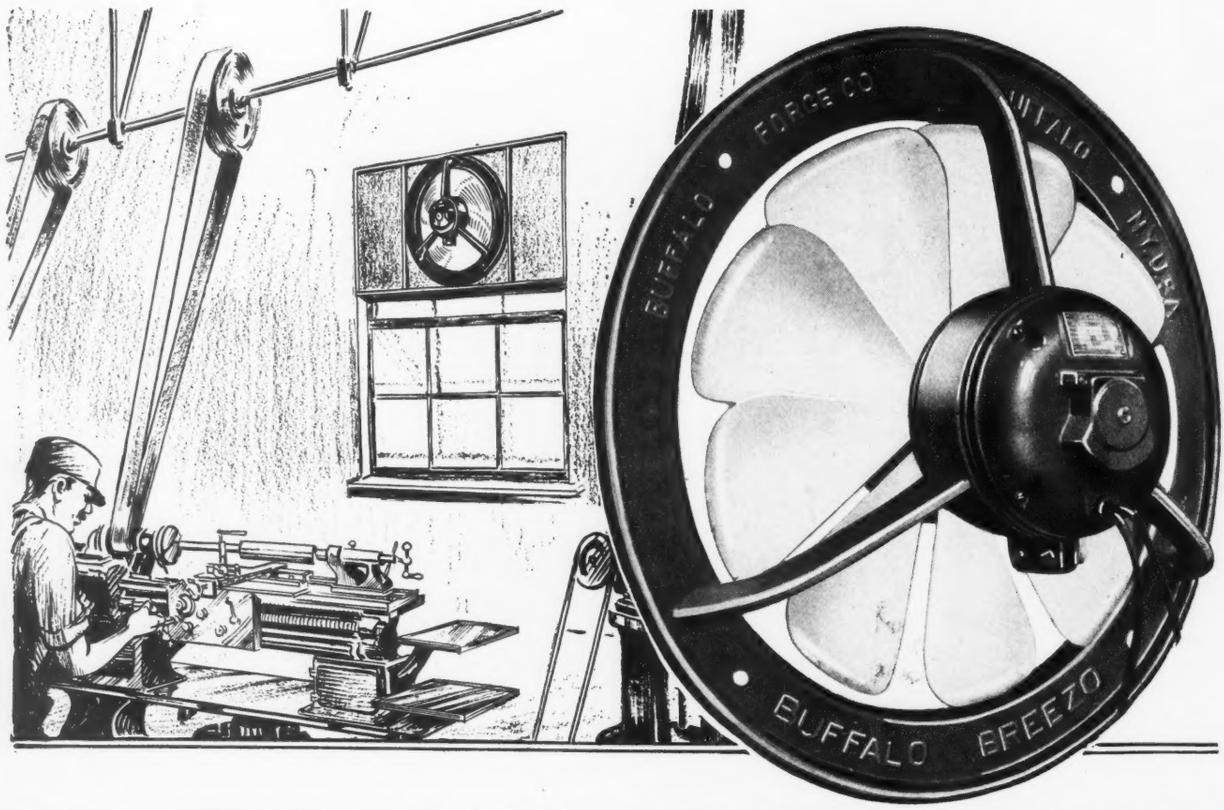
Ask for Catalog 90-Y.



LEEDS & NORTHRUP COMPANY
4901 STENTON AVENUE PHILADELPHIA, PA.

LEEDS & NORTHRUP

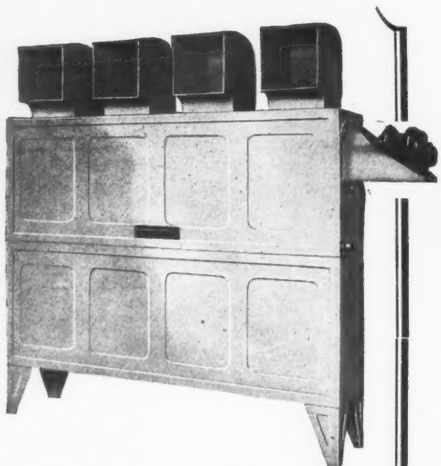
F-153 *Branch Offices:* CLEVELAND CHICAGO HOUSTON LOS ANGELES SAN FRANCISCO



FOR SHOP ROOMS OF AVERAGE SIZE—

Ventilate with "BREEZO"

. . . and save money!



And for plant heating!

"Buffalo" Unit Heaters concentrate and distribute a given quantity of heat more efficiently than any other method. The installation costs and operating expenses are very much lower than those of wasteful, inefficient open-radiating systems.

For the last word in plant heating and ventilating get our catalog 468.

Sleepy, lethargic workmen will pep up and work when the air in the shop is freely circulated by husky, powerful "Breezo" Fans.

Simple in construction — and in installation — these fans do a thorough ventilation job at the lowest possible cost. Two 30 in. or 36 in. "Breezo" furnish clean fresh air for a good sized factory room. They remove smoke and fumes, silently renewing the air during the entire day.

Contrast this simple, economical method with expensive central ventilating systems, and you will see why we supply so many "Breezo" Fans to metal-working shops.

We'll be glad to give you any information you want. Write.

BUFFALO FORGE COMPANY

144 Mortimer St., Buffalo, N. Y.

In Canada:

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Carborite *and* Borite

Wheels for Precision and Rough Grinding— Any Process

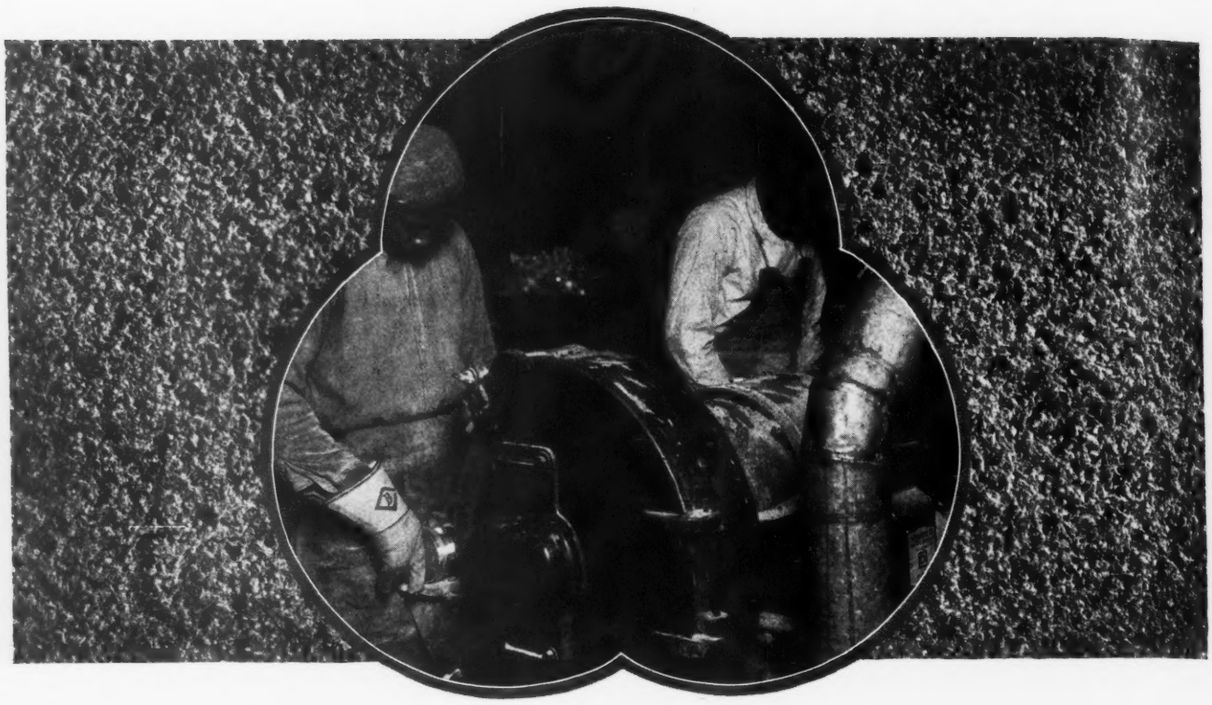
Whether you grind watch cases or cylinder heads, the chances are the job can be done faster and more economically with Carborite or Borite Grinding Wheels—both are marvels when it comes to low cost metal removing.

Carborite is recommended for superior results on cast iron, brass, bronze and aluminum. Borite, for rough grinding malleable iron, steel castings, forgings, etc.

Wheels are available in any grain, size and style—our experienced Engineering Staff will gladly suggest or design a wheel for your particular work. Write today for full information.

Vitrified Wheel Co.

Westfield, Mass.



"Our boys turn out more pistons in a day, and with each wheel, than ever before"

Tom Grinder

About a year ago one of the big Detroit companies, producing aluminum alloy pistons, changed over to resinoid bonded snagging wheels. Today, this company is getting more production from fewer machines, more pistons per wheel life and have effected a twenty per cent cut in the piece work rate.

These new wheels are twenty-four inches by five inches, with a twelve inch hole. Safely run at a speed of 9,000 surface feet per minute, instead of the usual five or six thousand feet, each operator has been averaging about 3,000 pistons per day, and a single wheel is good for almost a half million of these parts.

The open structure of this wheel and the low heat conductivity of the resinoid bond eliminates gumming and disagreeable odors. The wheel stays cool at high speed, and its fast cutting quality makes it easier on the operator. Suitable for almost any type of snagging, these wheels are effecting big savings for many users. Manufacturers will be glad to demonstrate the particular wheel for your job.

Abrasive wheels bonded with resinoids made by Bakelite Corporation are produced by all of the leading manufacturers. Names on request.

BAKELITE CORPORATION

247 Park Avenue, New York, N. Y. Chicago Office: 635 West 22nd Street

BAKELITE CORPORATION OF CANADA, LTD., 163 Dufferin St., Toronto, Ont.

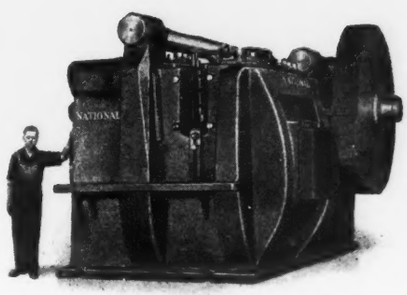
BAKELITE

REGISTERED U. S. PAT. OFF.

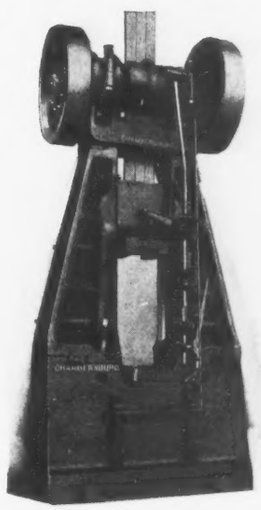
THE MATERIAL OF ∞ A THOUSAND USES

"The registered Trade Mark and Symbol shown above may be used only on products made from materials manufactured by Bakelite Corporation Under the capital "B" is the numerical sign for infinity, or unlimited quantity It symbolizes the infinite number of present and future uses of Bakelite Corporation's products."

Forging for the year after next



THE modern manufacturer plans today, not for next month's business, or next year's business but for the year after next. He who follows or even tries to slightly anticipate competition is always behind in the race for business. Manufacturers hoping to take care of future business with forging equipment built for today's requirements, will be facing the competition of those firms who are now installing Chambersburg-National equipment. For forging practice FOLLOWS Chambersburg-National design.



The engineering knowledge and experience of these two great companies are at your command. Call on any Chambersburg-National representative.

Chambersburg-National Sales Offices are located in Chambersburg, Pa., Tiffin, Ohio, New York City—152 W. 42nd St., Chicago—565 W. Washington St., and Detroit—2457 Woodward Ave.

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The standardization afforded by the Q-C Method means an improvement in tools, a saving of time and a reduction in tooling costs.

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GE Strom BALL BEARINGS

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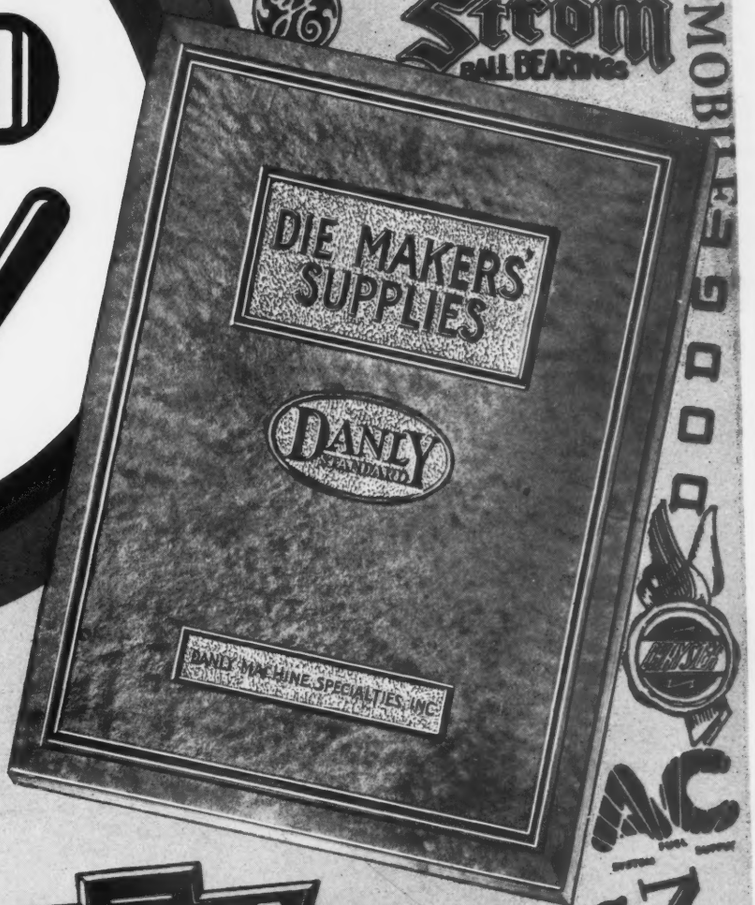

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TODAY "saving" is the big appeal. And savings are big wherever the Manual of the Metal Stamping Industry is used.

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M. 8-29

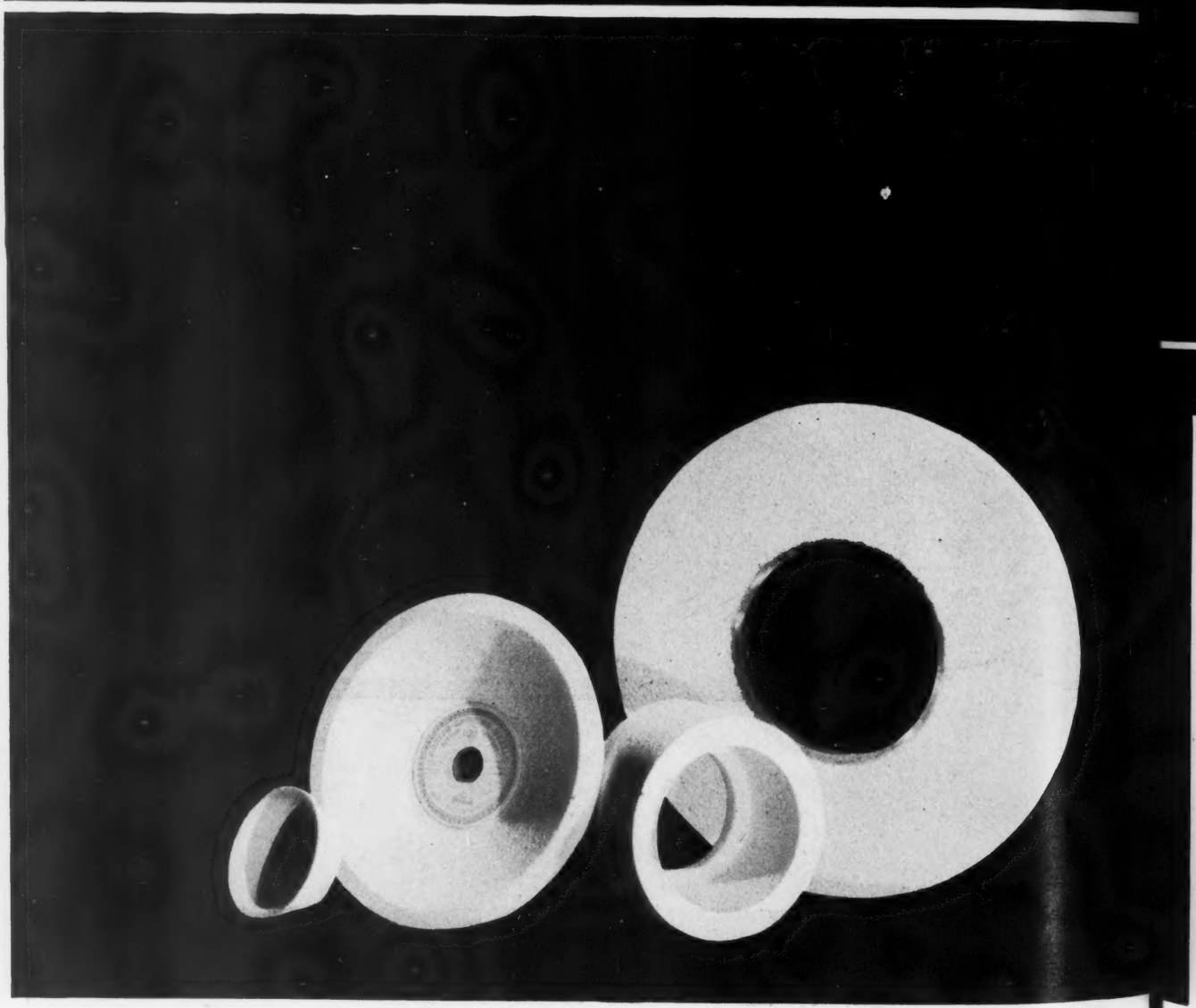
Today's Wheels for Today's Tool Rooms

Today's high speed steels and cutting tool alloys call for special attention to the grinding problem.

It is the job of the Norton laboratories with its staff of experts in all branches of grinding wheel manufacture and use to improve present products and develop new ones to meet today's grinding requirements.

The Norton "B" Wheel for High Speed Steels is a typical recent development

The laboratories took Alundum and 38 Alundum abrasives with their well-known advantages for tool grinding and added to them the advantages of an entirely new bond. The result is a wheel that is remarkably effective on high speed steels—that cuts extremely fast, free and cool and requires little dressing.



The Crystolon Wheel for Carboloy, Dimonite, Strauss Metal, Widia and other tungsten carbide metals is another example

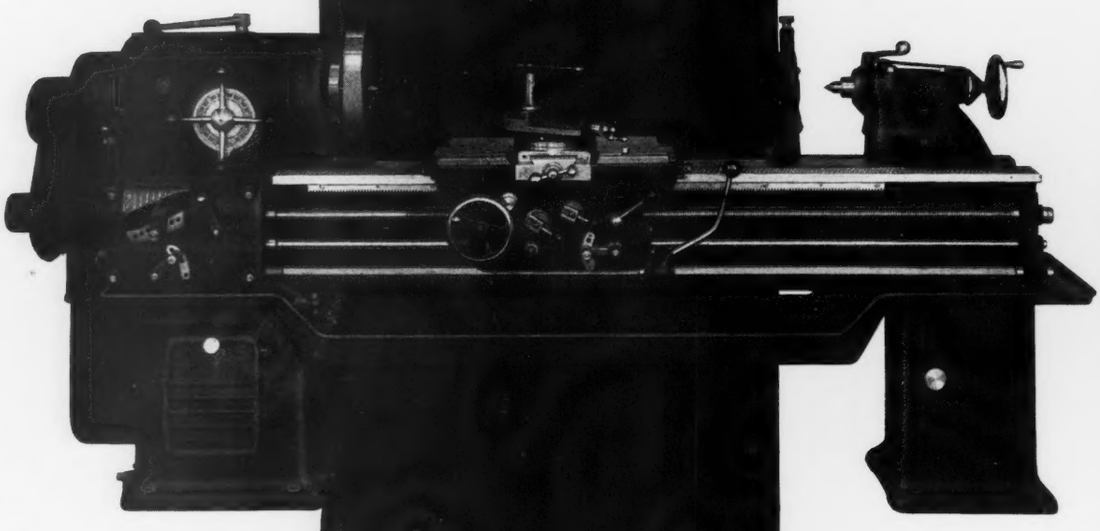
The introduction of the new tungsten carbide cutting tools brought a grinding problem. They called for a wheel entirely different from anything previously used in tool rooms. The Norton laboratories carried on extensive tests with the result that the grinding of the new cutting tool metal is no cause for worry or concern. The abrasive used is Crystolon and there is now a Crystolon wheel in grains and grades for both roughing and finishing tungsten carbide metals.

W-252

NORTON COMPANY, WORCESTER, MASS.
New York Chicago Detroit Philadelphia Pittsburgh
Cleveland Syracuse Hartford
NORTON COMPANY OF CANADA, Ltd.
Hamilton, Ont.

NORTON
GRINDING WHEELS

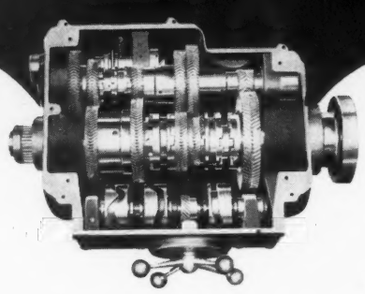
MONOTROL

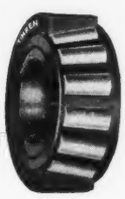


In Monotrol Engine Lathes there are combined so many practical features of advanced design that it is difficult to state just which are the most valuable to the plant manager.

The one lever, direct reading dial spindle speed control saves time and operator's effort; the Timken equipped spindles with their Herringbone Gears guarantee smoothness and accuracy; the positive snap lever control on the apron insures instant stopping and starting of longitudinal and cross-feeds — and develops power for unusually heavy cuts — the unique 3-point carriage support provides rigidity and steadiness for fast and heavy cutting.

So that you may study over just what Monotrol Engine Lathes can accomplish for you, we would be pleased to send you interesting literature describing them. A note on your letterhead, mailed today, will be enough.

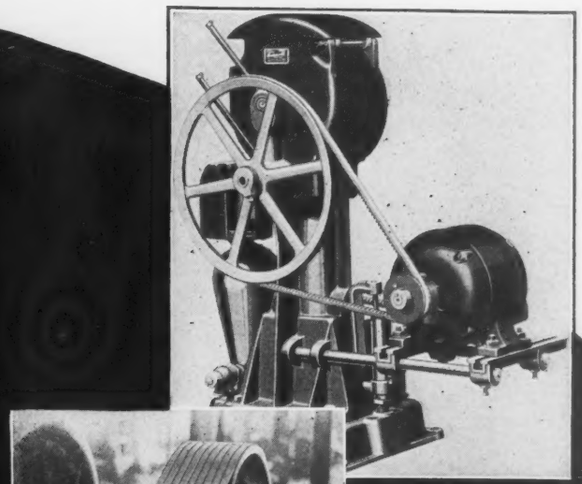


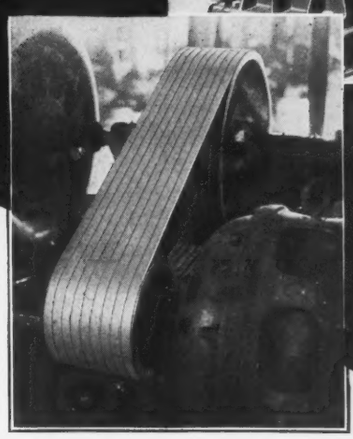


The SIDNEY MACHINE TOOL CO.

SIDNEY, OHIO

Fractional or 1000 horsepower . . .





WHEN it comes to the transmission of power—Dayton Cog-Belt Drives will do *any* job with greater efficiency—at less expense—and for a longer time. Their superiority is due to the following ten advantages, found in drives of no other type:

1. MINIMUM SPACE REQUIRED—Smaller pulleys and extremely short center to center distances possible without the use of idlers.
2. POSITIVE SPEED—Exact speed ratio maintained through greater gripping power.
3. RUGGED—Unaffected by dust or moisture-laden atmospheres.
4. SMOOTH STARTING AND RUNNING—Through "seating" action of belts in grooves.
5. VIBRATION ELIMINATED—No vibration transmitted between driving and driven machines.
6. LESS MAINTENANCE—Due to long life, belt replacement extremely infrequent. No lubrication necessary. No dressing.
7. LESS ADJUSTMENT—Pre-stretched construction and correct mechanical design eliminate necessity of frequent "take-ups."
8. QUIET—Particularly recommended wherever quietness is essential.
9. CLEAN—No oil or grease to leak or collect dust.
10. EASY ON BEARINGS—Greater gripping power permits less tension.

These ten advantages result from superior and exclusive construction features of the Dayton Cog-Belt. Send for a sample section. Study the belt for yourself. *Convince* yourself that here is the solution to your hardest power transmission problems. Mail the coupon *today!*

THE DAYTON RUBBER MFG. CO., *Dayton, Ohio*

Factory Distributors in principal cities and all Westinghouse Electric & Manufacturing Company's Sales Offices

Dayton
COG-BELT DRIVES

THE DAYTON RUBBER MFG. CO.,
Dayton, Ohio.

Gentlemen: Without obligation on my part, please send free sample section of Dayton Cog-Belt. I am interested in Dayton Cog-Belt Drives for

☐ *Use in plant* ☐ *Use on product*

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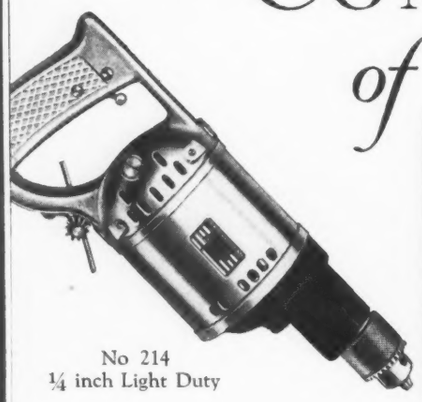
Company.....

Street.....City.....State.....

A Complete Range of Price and Power

in Millers Falls ¼ inch Electric Drills



No 214
¼ inch Light Duty

No. 414
¼ inch Standard

No. 514
¼ inch Heavy Duty

NO matter what your needs or what jobs you have calling for ¼ inch drills, a Millers Falls will suit your purse and your requirements. A complete range, from the No. 214 Light Duty for $25.00 designed for light and intermittent service, and the No. 414 Standard for $30.00 suitable for regular production work to the No. 514 Heavy Duty for $43.00 capable of standing up under rated load at continuous operation without overheating.

And you will find Millers Falls quality built into every one of these ¼ inch drills—more power per pound of weight; Millers Falls system of ventilation resulting in the lowest temperature rise load for load; great durability, meaning better staying powers on the job and longer life; less weight per horse power output.

We want you to test out these power tools on your own work. Convince yourself of their fitness for your needs. Ask any Millers Falls distributor to arrange a test—or write us. We will be glad to send you the new Electric Tool Catalog showing the complete line—Drills ranging from ¼ to ⅞ inches, Electric Screw Drivers, Hammers, Grinders and other power tools.

MILLERS FALLS COMPANY
MILLERS FALLS · · · Massachusetts

MILLERS FALLS TOOLS

NEW YORK: 28 Warren Street CHICAGO: 9 S. Clinton Street

The
Board of Directors
of the
EX-CELL-O TOOL
& MFG. CO.
Announce the
Changing of the
Company Name
to
EX-CELL-O
AIRCRAFT & TOOL
CORPORATION
of Detroit
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TOOL STEEL
BUILDER OF
CIVILIZATION

The American standard of living, envied throughout the world, is made possible by mass production. Automobiles, electric household appliances, heating plants, radios, etc., would be restricted to the wealthy were it not for the amazingly efficient tools of industry.

And behind the tool is the *tool steel,* constantly being improved to meet the ever increasing severity of faster manufacturing operations.

FIRTH-STERLING CONTRIBUTIONS have been conspicuous:

BLUE CHIP HIGH SPEED STEEL, in the early days of the present century, unsurpassed for twenty-five years.

STERLING STAINLESS, the first stainless steel made in the United States.

CIRCLE C, the first outstanding improvement in high speed steel in twenty years.

CROMOVAN TRIPLE DIE STEEL, a patented steel with extraordinary capacity for high production work.

For the near future, a new cutting material of astonishing possibilities, now being developed.

FIRTH-STERLING STEEL COMPANY

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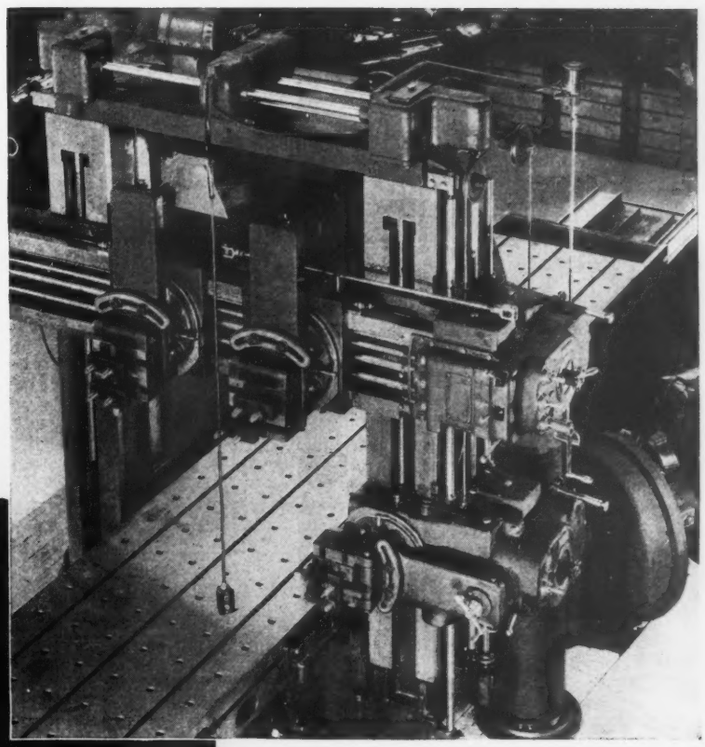
PLANER *or* PLANER-MILLER?

. . . which tool do you need?



The Sellers 48" x 48" Planer

The Sellers 64" x 60" Planer Type Milling Machine

PERHAPS the planer you are now using should be replaced with a modern tool that will pay for itself in reduced production costs. On the other hand, a planer type miller may be the correct tool for your work.

The Sellers Planer Type Milling Machine and the Sellers Planer are two tools that have been built to meet not only the high production demands of today but to anticipate those of the future. We would welcome an opportunity to confer with your production department to determine the type of tool—planer or miller—which will most economically do your particular job.

WILLIAM SELLERS & CO., Incorporated
1600 Hamilton Street Philadelphia, U. S. A.

Starrett Micrometers —used by men who do fine work

For work demanding close limits, Starrett Micrometers are made to a nicety for precision.

They handle to the queen's taste—easy to read — and are rugged to stand the gaff of daily use.

Starrett Micrometers are made in styles for every need, but above all, they are dependable.

The Starrett Catalog No. 24 "D" describes over 2500 Starrett Tools. A post card will bring your copy.

THE L. S. STARRETT CO.

World's Greatest Toolmakers
Manufacturers of Hacksaws Unexcelled
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Use Starrett Micrometers

2443

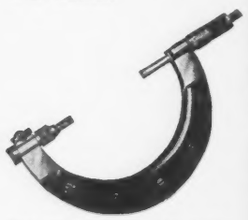
STARRETT MICROMETER
No. 210
Screw Thread Comparator
No. 210A Range 0-1 inch
No. 210B Range 1-2 inches

STARRETT MICROMETER
No. 226
One inch by thousandths
An accurate tool moderately priced. In six sizes—1 to 6 inches. Supplied singly or in sets. 1, 2, 3 and 4 inch sizes furnished to read in ten thousandths at small additional cost.

STARRETT MICROMETER
No. 230
Range 0 to 1 inch by thousandths
With cut away frame for use in places where ordinary anvil can not be inserted. No. 231 is same tool except graduated for ten thousandths.

STARRETT SCREW THREAD MICROMETER
No. 575—*One inch*
Capacity range from 575A (8 to 13 threads) to 575D (32 to 40 threads).

No. 585—*Two Inch*
Capacity range from 585A (4½ threads to 7 threads) to 585D (22 to 30 threads).



STARRETT MICROMETER
No. 127
Range—0 to 4 inches, 4 to 8, 8 to 12, 12 to 16, 16 to 20, 20 to 24, by thousandths.
Used by U. S. Government for heavy Ordinance work. Frames steel plate covered with hard rubber. Interchangeable tail spindles of different lengths are provided to give above capacities.

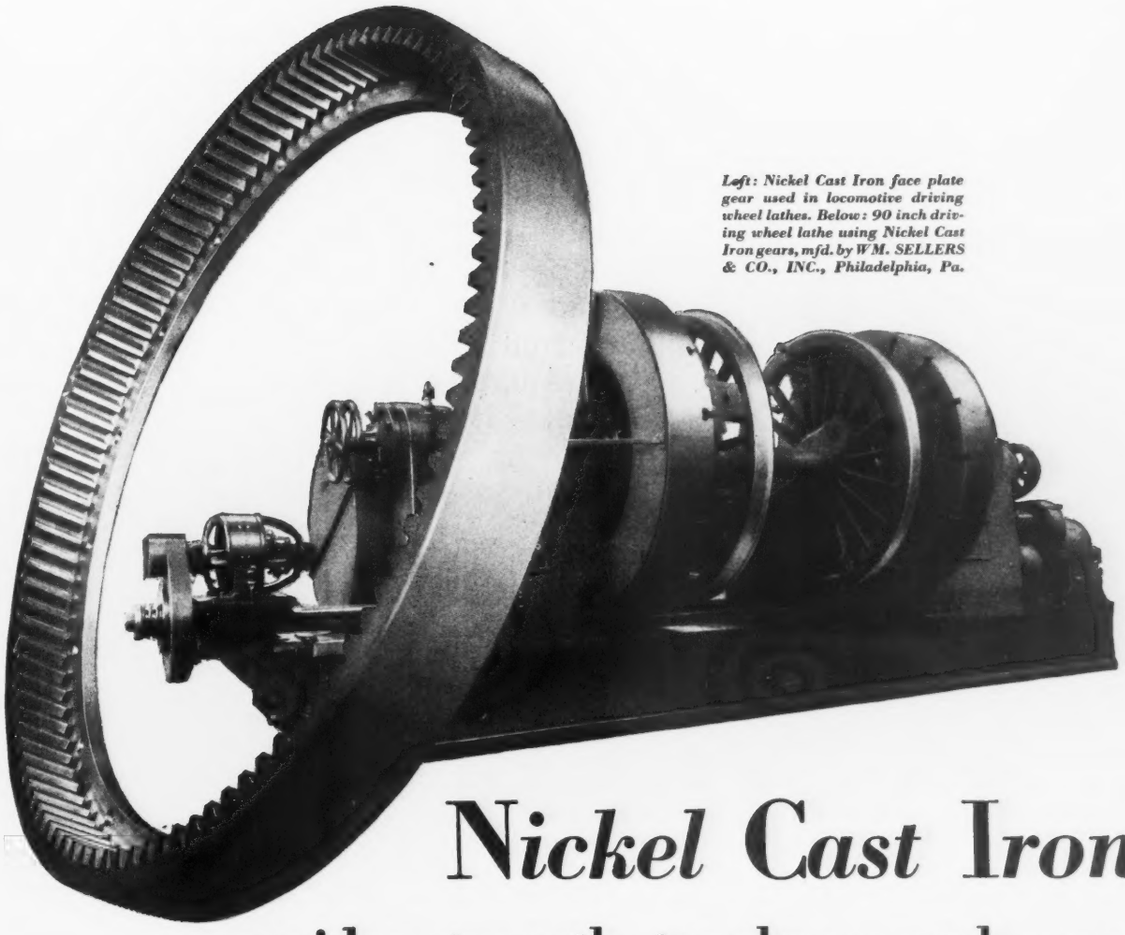
STARRETT MICROMETER
No. 2
Range 1 to 2 inches by thousandths
Furnished with lock nut at *end* of frame when desired.

STARRETT MICROMETER
No. 436
Black enameled Frame
Range 1 inch by thousandths in 6 sizes, 1 to 6 inches. Supplied singly or in sets. Priced low.

STARRETT MICROMETER
No. 3
Range 0 to 1-inch by thousandths
A popular Starrett "Mike" for all-round use. Lock nut furnished at *end* of frame if desired.

STARRETT MICROMETER
No. 222
For measuring Sheet Metal With 2 and 6 inch Frame Depth
2 inch depth furnished with ½ inch screw movement. 6 inch depth has 1 inch screw movement. Each size has regular Starrett friction sleeve adjustment.

STARRETT MICROMETER
No. 224
Range 2 to 6 inches, 6 to 9, 9 to 12, 12 to 16, 16 to 20, 20 to 24 by thousandths. Supplied singly or in sets. Interchangeable anvil gives a capacity that means a big saving in tool equipment. Black enameled Frame, well balanced and exceptionally easy to handle.



Left: Nickel Cast Iron face plate gear used in locomotive driving wheel lathes. Below: 90 inch driving wheel lathe using Nickel Cast Iron gears, mfd. by WM. SELLERS & CO., INC., Philadelphia, Pa.

Nickel Cast Iron

provides strength, toughness and wear-resistance in Sellers' heavy 90 in. Lathe Gears

THESE large Nickel Cast Iron gears are used in lathes for turning locomotive driving wheels having diameters as great as 90 inches. Such wheels are turned in pairs and machined simultaneously. The roughing cuts on each are as much as ½ inch deep with ⅜ inch feed, whereas the final finish must be smooth. The gears used in this equipment, therefore, must maintain proper accuracy and possess unusual strength and toughness to resist abuse.

Prior to the use of Nickel, in order to secure a close-grained condition at the roots of the cut teeth, it was necessary to pour the heavier sections of these castings against a chill. Although weighing 4,460 pounds and having sections as heavy as 3¾ inches, the gears are now produced satisfactorily from a 2% Nickel Cast Iron without the use of chills.

The present Nickel Cast Iron mixture provides a material which is uniformly dense and is readily machinable throughout. In support of this uniformity may be quoted the spectacular results obtained in a laboratory test conducted by the above company in which standard .80 inch diameter tensile test bars taken from the center of a 6″ x 18″ cylinder broke at more than 33,000 pounds per square inch.

Nickel
FOR CAST IRON

VISIT OUR BOOTH

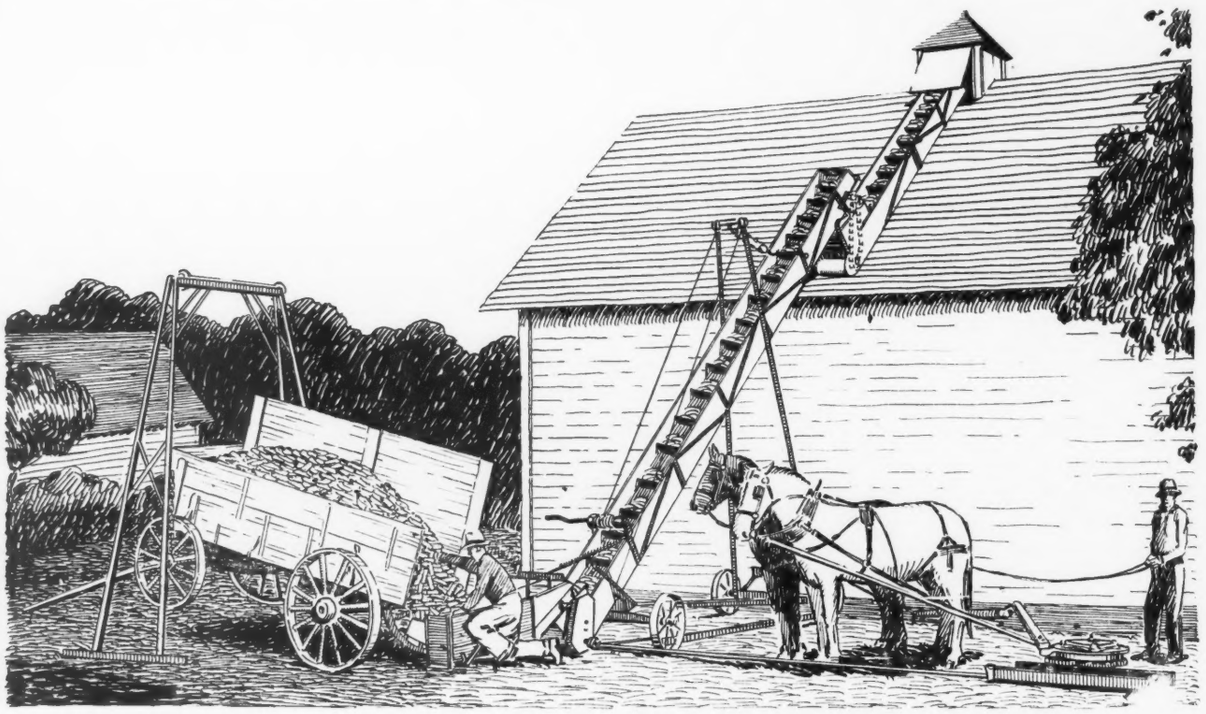
SPACE NO. 94

THE INTERNATIONAL NICKEL COMPANY, INC., 67 WALL STREET, NEW YORK, N. Y.

One Kind of

RIGIDMILING helps the farmer. Strange, perhaps,—but true. By producing work in large volume at low cost, Rigidmiling enables the manufacturer of agricultural equipment to offer high grade products at prices which secure wide distribution. Rigidmiling has such a prominent part in automobile manufacture that it might reasonably be expected to have a place in making tractors for farm use, and so it does—an important part. Rigidmiling serves also the builders of other farm machinery—grain elevators, corn shellers, spreaders and similar equipment.

Illustrated is a Rigidmil squaring shaft-ends in the John Deere plant. Two simple fixtures, each holding five pieces of cold rolled steel, are used. The operator clamps and removes work in one fixture while milling is in progress on the other. The shafts milled become parts of "horsepowers," devices for transforming animal energy into mechanical power for numerous tasks on the farm.

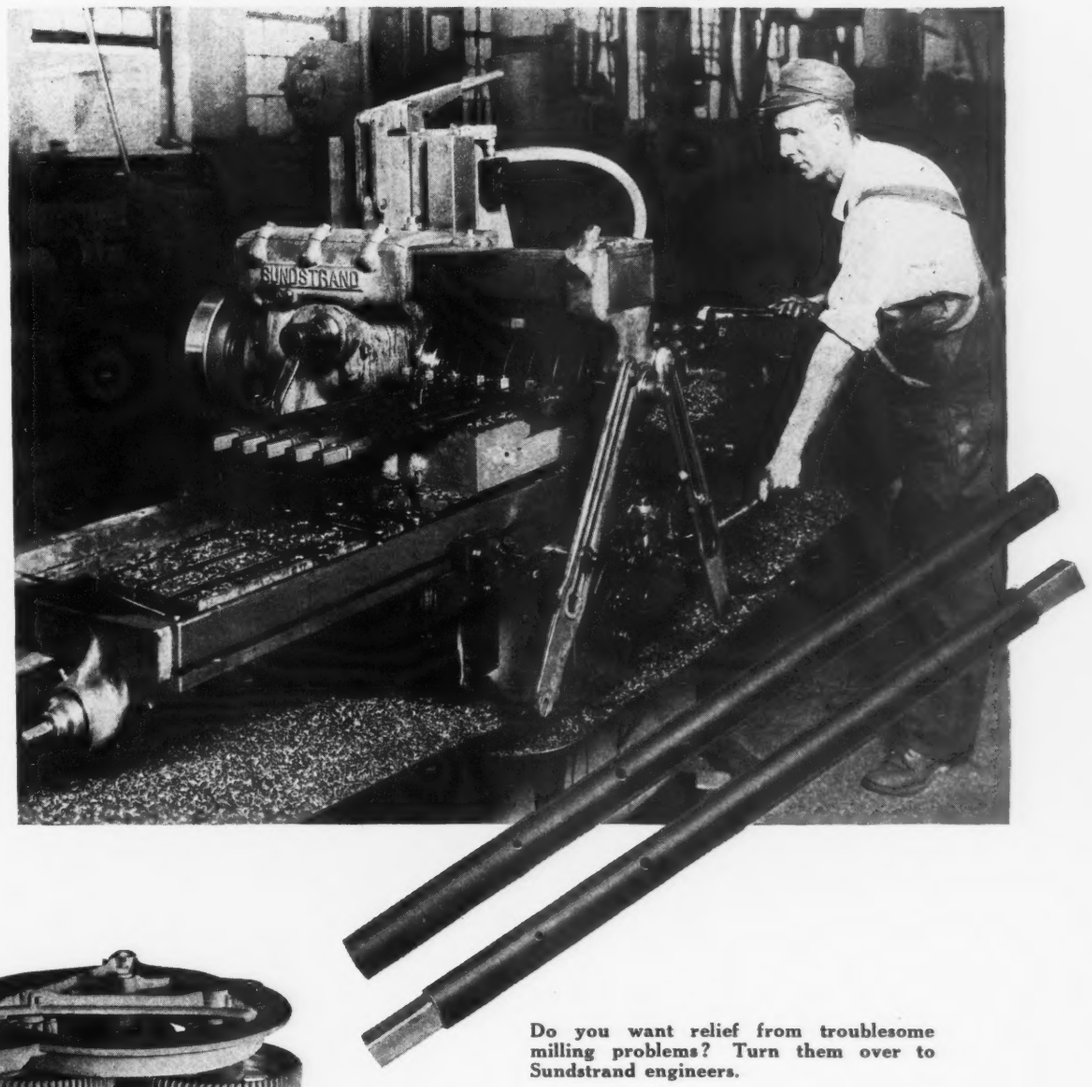


Sketch above shows one application of a John Deere horsepower. The machine itself is pictured at the right.

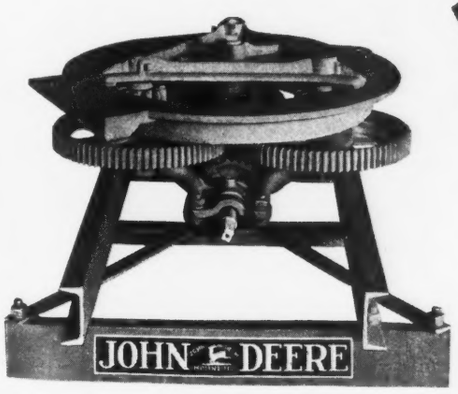
RIGIDMIL

Sundstrand Ma
Lathes~Milling Machines
ROCKFORD IL

nd of Farm Relief



Do you want relief from troublesome milling problems? Turn them over to Sundstrand engineers.

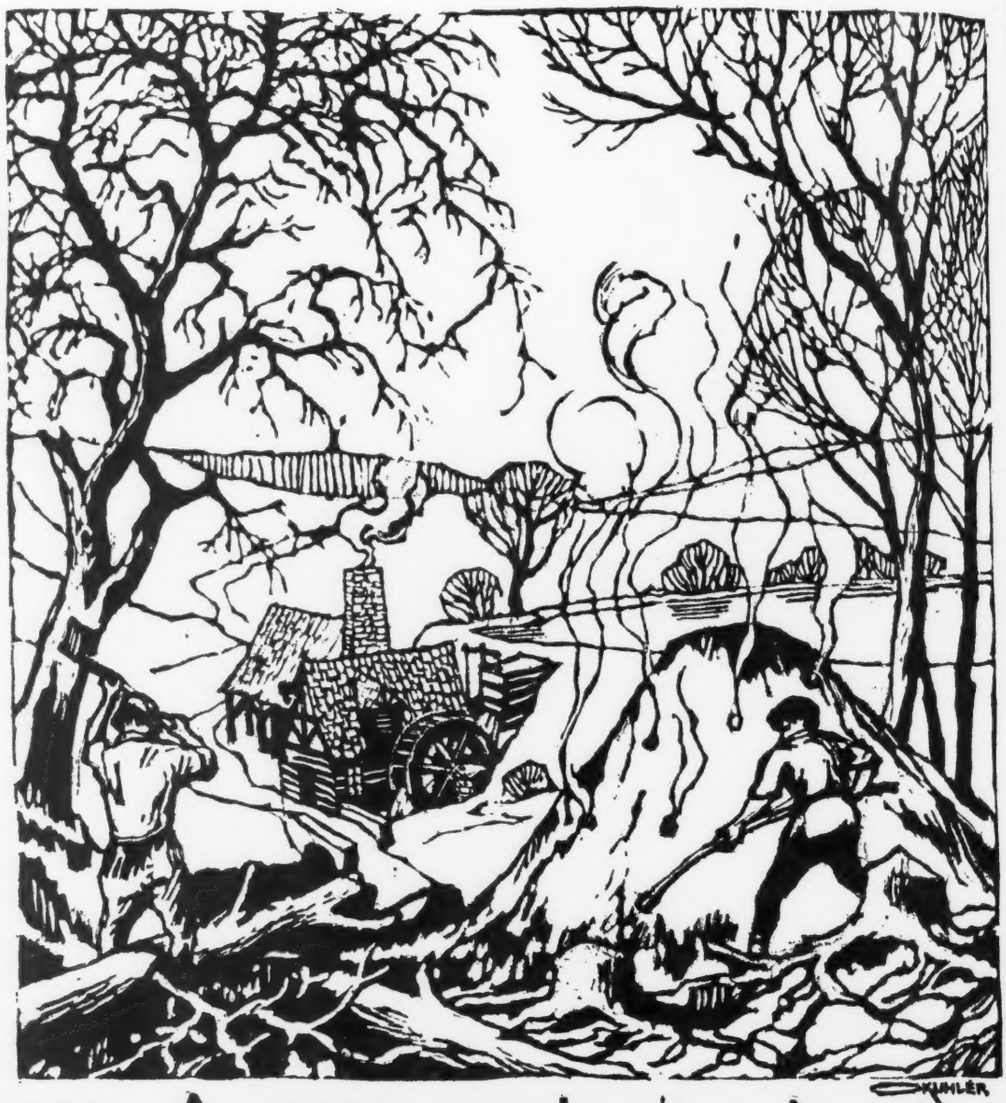


achine Tool Co.

nes Centering Machines-Balancing Tools

RD ILLINOIS, U.S.A.

RIGIDMIL



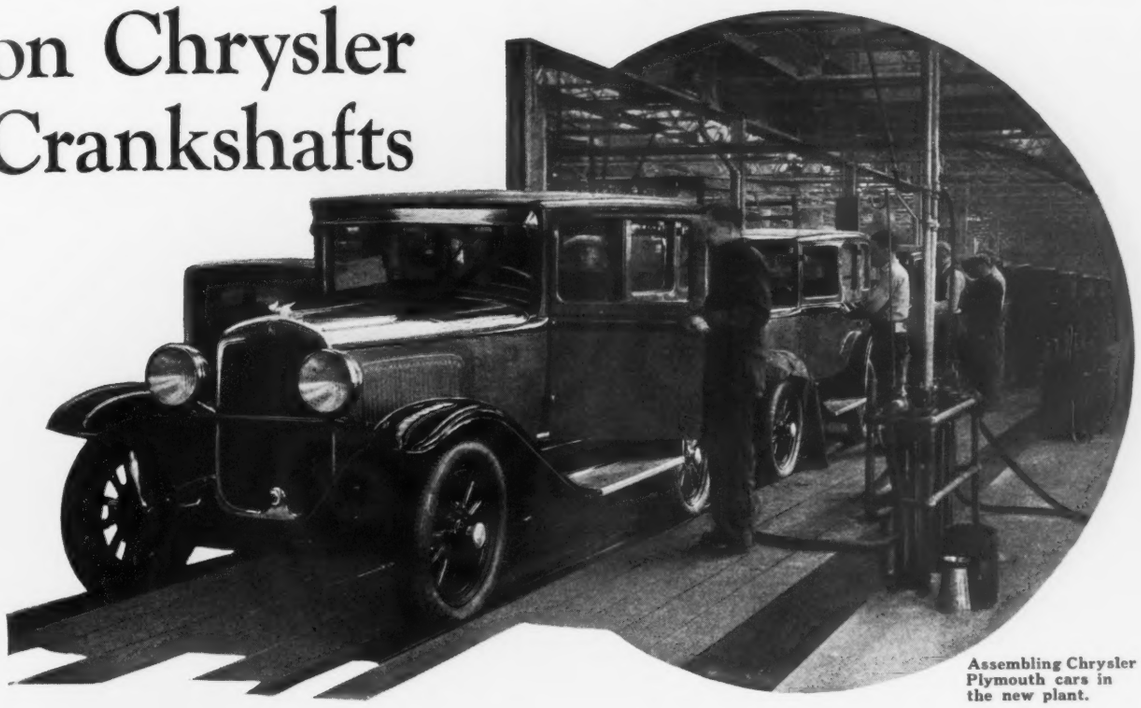
In the early days of iron making the smelters and foundries were invariably located close-by both forests and iron ore deposits. Charcoal made by slowly burning the wood in mounds, was used as fuel for smelting the iron. Blast equipment was driven by water power, often from an artificial lake.

CHARCOAL PIG IRON

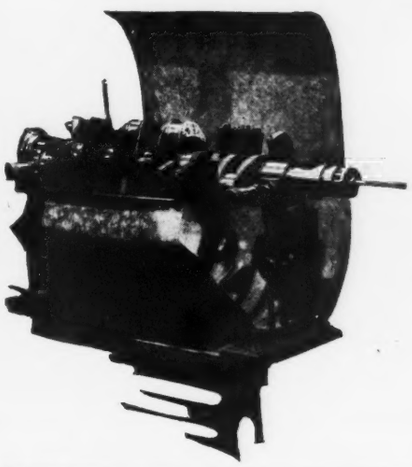
The history of making Charcoal Pig Iron is the oldest story of iron making; and it is the story of the very highest quality, purest pig iron ever produced. Even in this day of modern, improved blast furnace practice, Charcoal Pig Iron persists unsurpassed in essential qualities not found in ordinary pig irons; fine close grain, great strength and toughness, and uniformity of physical structure. These qualities are imparted to Charcoal Iron Castings eliminating many foundry troubles, and insuring higher grade finished products. Write for a booklet which gives complete details.

SUPERIOR CHARCOAL IRON CO.
GRAND RAPIDS • MICHIGAN
DEBEVOISE-ANDERSON COMPANY, INC., Eastern Representative
NEW YORK • • • BOSTON • • • PHILADELPHIA

Olsen Balancing Machines on Chrysler Crankshafts



Assembling Chrysler Plymouth cars in the new plant.



Increased Production 300%

"We get better work at greater speed," says the Superintendent of the Chrysler, Detroit plant in which the Olsen Balancing Machine was first installed.

Each Olsen Balancing Machine balances 18 crankshafts per hour as against 6 per hour by previous methods; fewer machines are needed to handle a given amount of work; they use less floor space and need fewer operators, saving considerably on overhead and operating costs.

All of which counted when they equipped the new Chrysler, Detroit, Plymouth plant, and influenced the choice of Olsen Balancing Machines for this most modern automobile production unit.

Olsen Testing Machines are simple and easily operated. Economical precision insurance for all classes of industrial production. Send for details.

Olsen Products

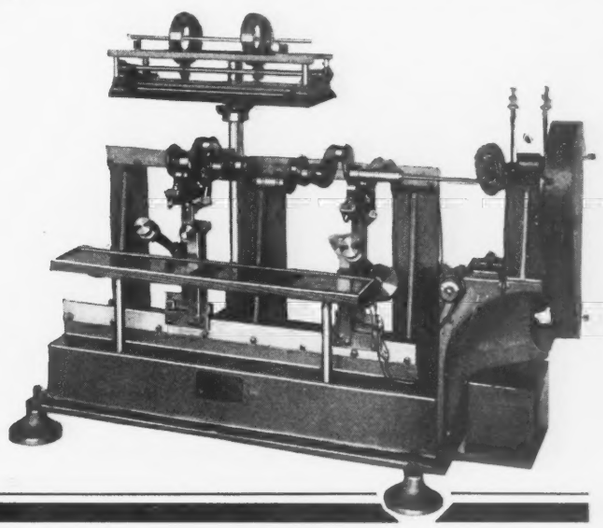
Autographic Universal Testing Machines

Olsen Static-Dynamic Balancing Machines

Olsen Production Type Motor Driven Brinell Hardness Testers

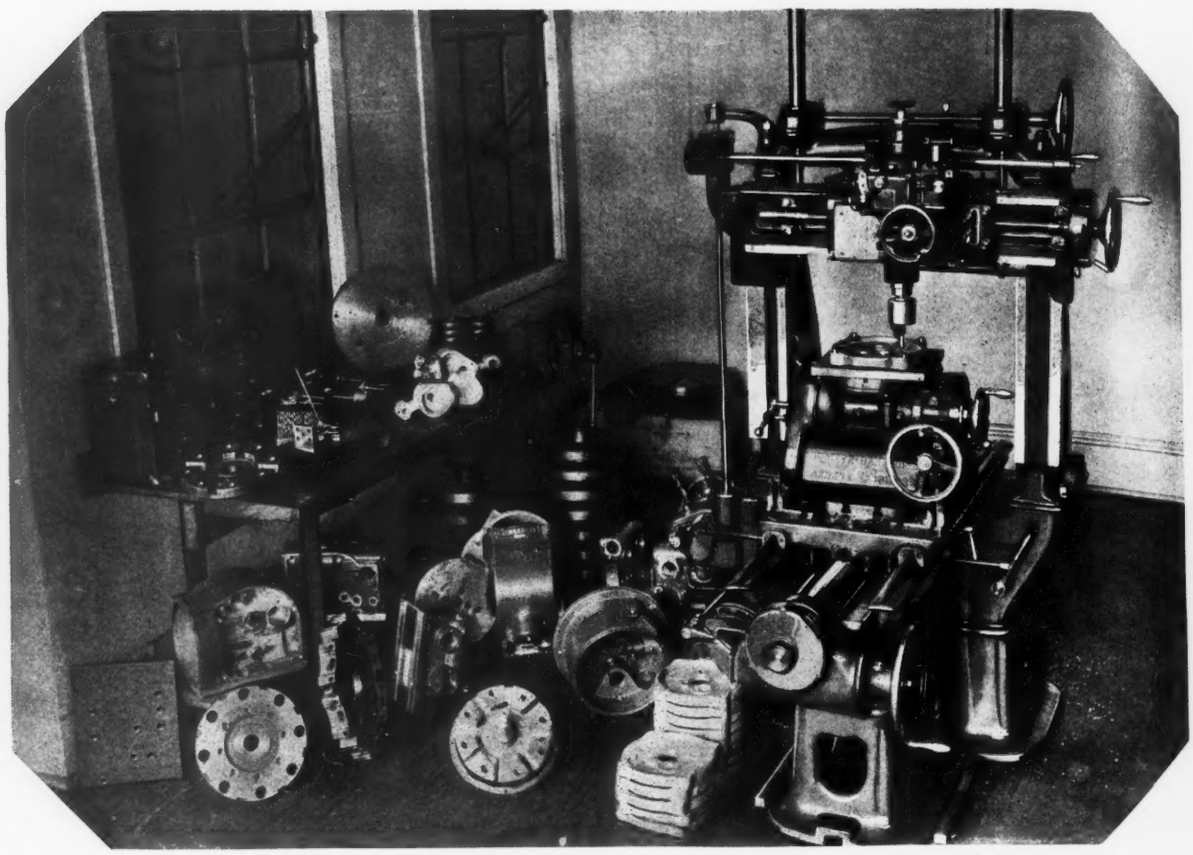
and

Testing Machines for all Industrial Materials



Tinius Olsen Testing Machine Co.

500 N. 12th St., Philadelphia, Pa.



An Unqualified Endorsement by the Kingsbury Machine Tool Corp.

"We use this machine for special machine parts or anything pertaining to Kingsbury Machines that requires accuracy."

The Factory Manager, the Kingsbury Machine Tool Corp., Keene, N. H.

The photograph shows samples of such work grouped around the Swiss Jig Borer; the operation in progress is on an experimental aluminum adapter plate for the reversing tapping mechanism of a Kingsbury Machine. The diameters of the holes are held to within plus or minus standard ball bearing limits required. Center distances are held to plus or minus .0005". The operation is completed in less than half the time required by methods previously used.

Users endorse Swiss Jig Borers because they simplify production of difficult and exacting work. Adjustments for position and accuracy are so easily made that though these are essentially precision machines the time saved on special machine parts, dies, jigs, etc., makes a big difference in production costs.

Send for "Questions to Ask Before Buying a Jig Borer" —an illuminating introduction to this important subject. Also our booklet "Modern Precision Boring" with data on installations and operations.

See Our Exhibit at the NATIONAL METALS EXPOSITION Cleveland Sept. 9th-13th

SWISS JIG BORER

THE R. Y. FERNER CO.

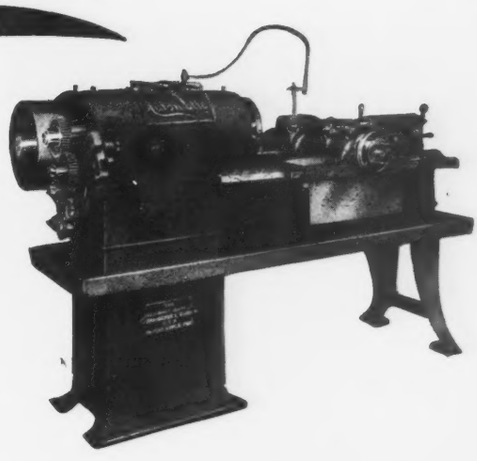
Investment Bldg. UNITED STATES AND CANADIAN AGENTS WASHINGTON, D. C.

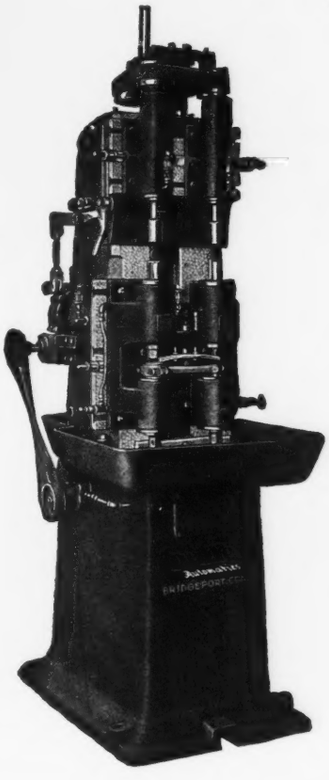
SOCIETE GENEVOISE d'INSTRUMENTS de PHYSIQUE
Home Office and Works:
8 Rue des Vieux Grenadiers, Geneva, Switzerland
London Office:
Societe Genevoise, Ltd., 95 Queen Victoria St., London, E. C. 4

REPRESENTATIVES:
New York City: Triplex Machine Tool Co., 50 Church Street
Detroit: Walter S. Ryan Company, General Motors Building
Chicago: Neff, Kohlbusch & Bissell, 806 West Washington Blvd.
San Francisco: Joseph C. Fletcher, 770 Folsom Street

"THE **Coulter** Automatics FAMILY"

make profits for all who use them because they increase production, minimize waste and are economical to operate and maintain. They will make profits for you.





DIAMOND TOOL BORING MACHINE

A precision tool for finish-boring where all dimensions must be held to uniformly accurate limits. The diamond excels all other tools for close work at high production. Write for details.

HOB THREAD MILLING MACHINE

For hobbing straight or taper, internal or external threads accurately and in perfect alignment at high production speeds and low costs. The way to extra profits from your threading jobs will be explained upon request.

AUTOMATIC THREADING LATHE

Adapted to cutting any form of thread desired, single or multiple, straight or taper, internal or external. A time and equipment saver that is always a little ahead of the increasing demand for accuracy. Write for catalog.

OPEN-SIDE SHAPER PLANER

This combination tool is economical of time and space. It has all the precision and speed features of the shaper and extra capacity as a planer because of the open-side design. Write for catalog.

THE AUTOMATIC MACHINE CO.

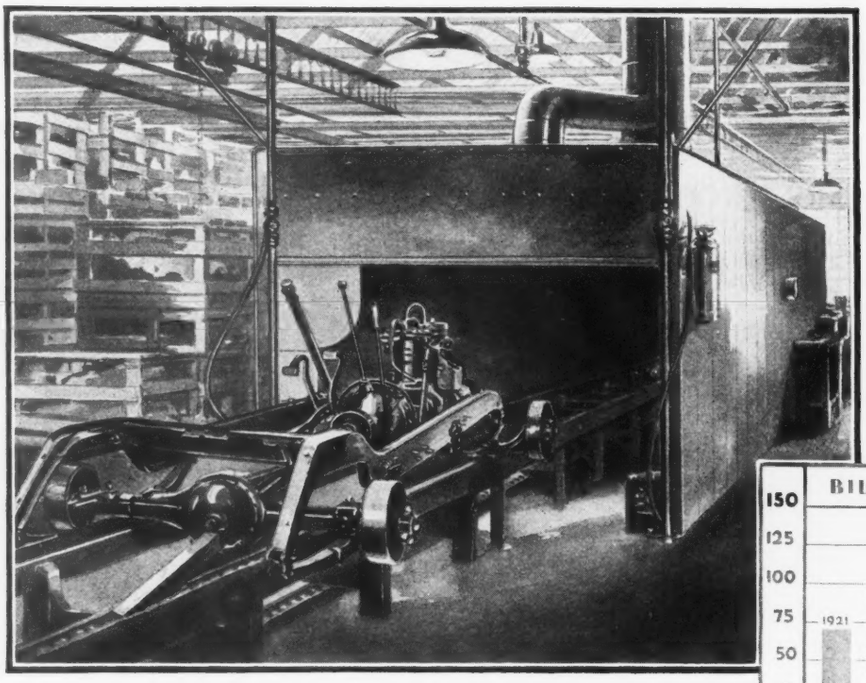
BRIDGEPORT, CONN.

Coulter Automatics

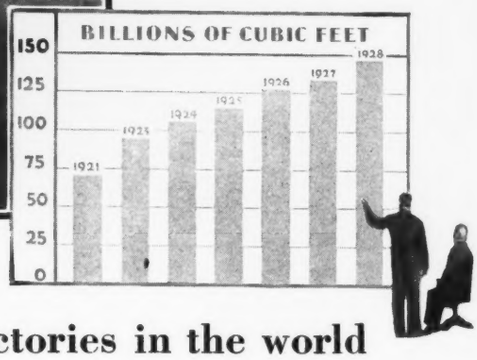
DIAMOND TOOL BORING MACHINES
THREADING LATHES - SHAPING PLANERS
PROFILERS - HOB THREAD MILLERS

GAS HEAT

keeps great automobile factories humming.....



Each year Industry uses more manufactured gas. The chart represents the increase by years since 1921. Significant!



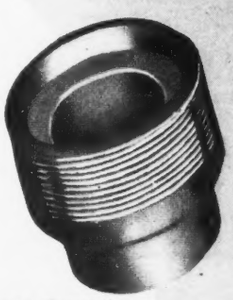
ONE of the largest automobile factories in the world employs more than four hundred gas-fired units in the production of cars. The uses range from steel melting to final heat-treating and normalizing ...they do it *better* with gas. Get the story...Write

AMERICAN GAS ASSOCIATION
420 Lexington Avenue, New York

If it's done with heat,
you can do it better with

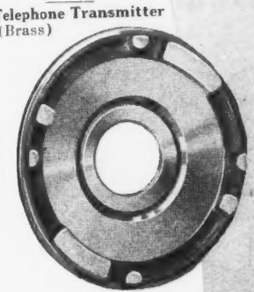
GAS

A Real Dynamo in the Electrical Parts Field



Conduit Connection (Steel)

Telephone Transmitter (Brass)



Insulator Thimble (Cast Iron)

Conduit Box (Malleable Iron)

How many times has it been written that in the final analysis for goods of equal quality, the price to the consumer (and the profit to the manufacturer) is determined by competition.

That is a lesson early learned by all of the makers of electrical parts, which explains why all of them are on their toes when it comes to production methods. They are digging sizeable profits out of the manufacturing end of the business, relying on low selling prices to create the needed volume.

Here we show four characteristic parts—a few of the hundred different ones that flow off of Goss & DE Leeuw Automatics in countless volume.

With four spindles working on four parts simultaneously, with all tools individually speeded to give the highest machining speed on every kind of operation and metal, the Goss & DE Leeuw Automatic Chucking Machine turns out as much work as four to six hand operated machines.

This advanced type of machine incorporates a number of new and exclusive features that set it apart from similar equipment. If you handle chucked work up to 11 in. dia. x 10 in. long, it will pay you to find out what this machine can do for you.

A new illustrated catalogue explaining in detail the various interesting features will be sent to anyone. Write for your copy today.

The GOSS & DE LEEUW MACHINE COMPANY
New Britain, Conn.

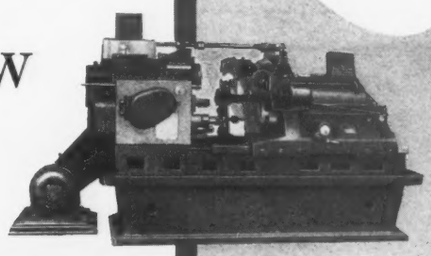
features

Each tool spindle individually speeded by change gears gives utmost efficiency on every type of machining operation.

Positive Lead Siren Threading insures accurate threads with practically no tap breakage.

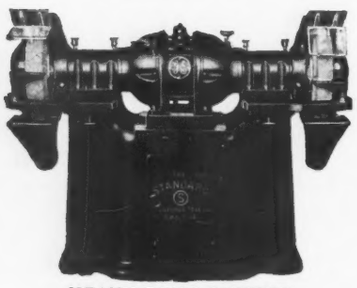
Micrometer setting facilitates set-up and easy maintenance of facing and necking dimensions.

Electric Chucking Device —provides greater gripping power where heavy cuts on tough work are required, with no fatigue on operator's part.



GOSS and DE LEEUW 4-SPINDLE AUTOMATIC CHUCKING MACHINES

Standard Ball Bearing Grinders, Polishers and Buffers



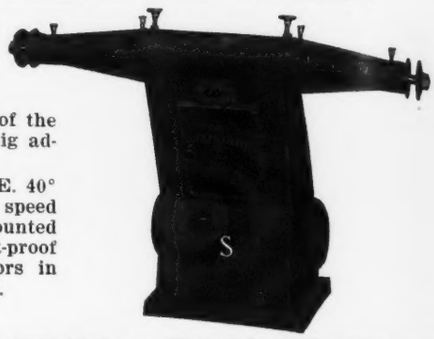
HEAVY DUTY GRINDER
G. E. 40 Degree Motor and Push Button Control. Four S.K.F. Ball Bearings. Nickel Steel Armature Shaft. Made in 5, 7½ and 10 H.P. sizes.

CUT ON THE RIGHT SHOWS OUR RIGHT SPEED BALL BEARING BUFFER AND POLISHER WITH DAYTON COG BELT DRIVE

The spindle overhangs the bottom of the front of base 8 inches, which is a big advantage for large work.

Made in 3, 5, and 7½ H.P. sizes G.E. 40° Ball Bearing Motor. Can obtain any speed from 2000 to 3200 R.P.M. Shaft mounted on four S. K. F. Ball Bearings in dust-proof chambers. Also made with 2 motors in Base with each spindle independent.

Write for Catalog.



THE STANDARD ELECTRICAL TOOL COMPANY
ESTABLISHED 1912 CINCINNATI, OHIO

Send for Bulletin 18.

More Grinding at Less Cost

Using little floor space, economical with power and costing little to install, this Thompson Universal Grinder possesses a range that produces profitable results on every grinding job in the average shop. This includes cylindrical or taper grinding, surface, edge, internal, cutter and reamer grinding. Machine has stationary head and wheel, and a table that can be quickly and accurately set at any angle to the wheel.

The Thompson Grinder Co.
1534 W. Main Street, SPRINGFIELD, OHIO, U.S.A.

FLAT WORK
GRINDERS

TWO SIZES 12'—18' HIGH GRADE

For rapid production of flat surfaces that will be straight from end to end

18-inch Grinder
Showing Motor Bracket. Water Guard Omitted.

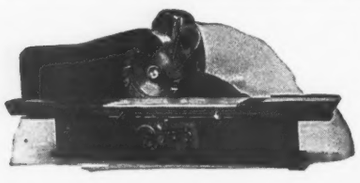
You can readily fasten stationary, rotary or Magnetic Holders on the table to suit your particular case

ADAPT AND USE AS A BASE

A good example is our PULLEY GRINDER on which we have special circulars.

THE GRAHAM MFG. CO.
71 Willard Avenue Providence, R. I.

Great Britain—Richard Lloyd & Co., Ltd., Birmingham
France, Italy, Switzerland, Spain and Holland—Fenwick Freres & Co.



Bridgeport Hydraulic Face Grinders

Bridgeport Hydraulic Face Grinders are powerful, high speed machines, ruggedly built to insure accuracy and durability. Hydraulic table drives at any speed up to 85 feet per minute. Features include a special Bridgeport Spindle which takes 26", 32" or 42" Bridgeport Sectional Wheels. Unusual economy and ease of operation. Send for complete details.

The Bridgeport Safety Emery Wheel Co., Inc.
1283 West Broad Street, BRIDGEPORT, CONN.

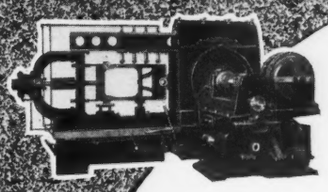
Emery Wheel Dressers

Two Sizes **CUTTERS** Nos. 1-2

We make the regular Huntington (Pattern) for all sizes. Roughing for Nos. 1 and 2. Paragon for No. 1 only.

GEO. H. CALDER CO., Lancaster, Pa., U.S.A.

GARDNER FLAT SURFACE GRINDERS



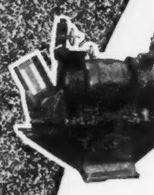
Where HIGH PRODUCTION *is required!*

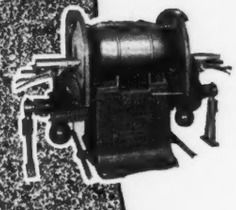
FOR almost any flat surface job WHERE HIGH PRODUCTION IS REQUIRED, there's a MODERN GARDNER GRINDER to meet just such requirements.

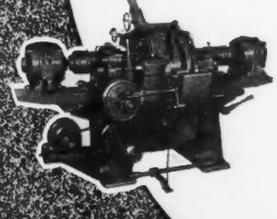
Huge boiler sections, brake shoe lining, transmission covers, crank case covers, connecting rods, fly-wheel housings -- PRACTICALLY ANY parts of this nature, and many which are much larger and more difficult to handle -- are being GARDNER-GROUND on the newer types of HIGH-PRODUCTION GARDNER GRINDERS.

The Production Executive naturally demands PROOF of what these tools can accomplish.

WE HAVE IT FOR HIM, in the form of two booklets, wherein representative machines AND OPERATIONS are shown, and production figures quoted.



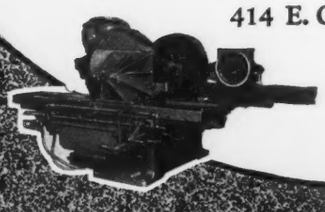




Ask for these "OPERATION BOOKLETS"— there are TWO reaay for YOU!

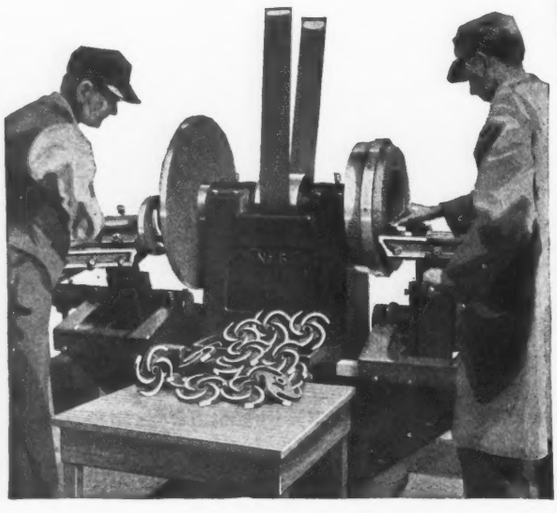
GARDNER MACHINE CO.

414 E. Gardner St., Beloit, Wis., U. S. A.



GARDNER

9 times Lathe Production on this Badger Grinder



This is just one of the hundreds of jobs where remarkable increases in production are made by using Badger Grinders.

For example, the cast iron impellers shown in the illustration were formerly turned on a lathe. A Badger now grinds them right from the rough with greater accuracy at nine times the lathe production.

Discuss your grinding problems with our Engineering Department.

COVEL-HANCHETT COMPANY

WILMARTH & MORMAN Division

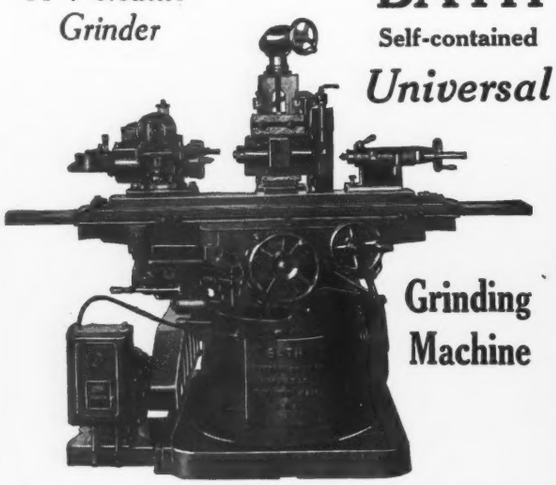
BIG RAPIDS, MICHIGAN

A Versatile Grinder

BATH

Self-contained

Universal



Grinding Machine

THE Bath Grinder embodies many distinctive and desirable features essential for rapid and accurate production of commercial and tool room grinding.

This machine is adapted for the grinding of cylindrical, internal, surface, disc, cutter and reamer work of all kinds. Made in 2 sizes—12x36; 10x25. Drop a post card for catalog.

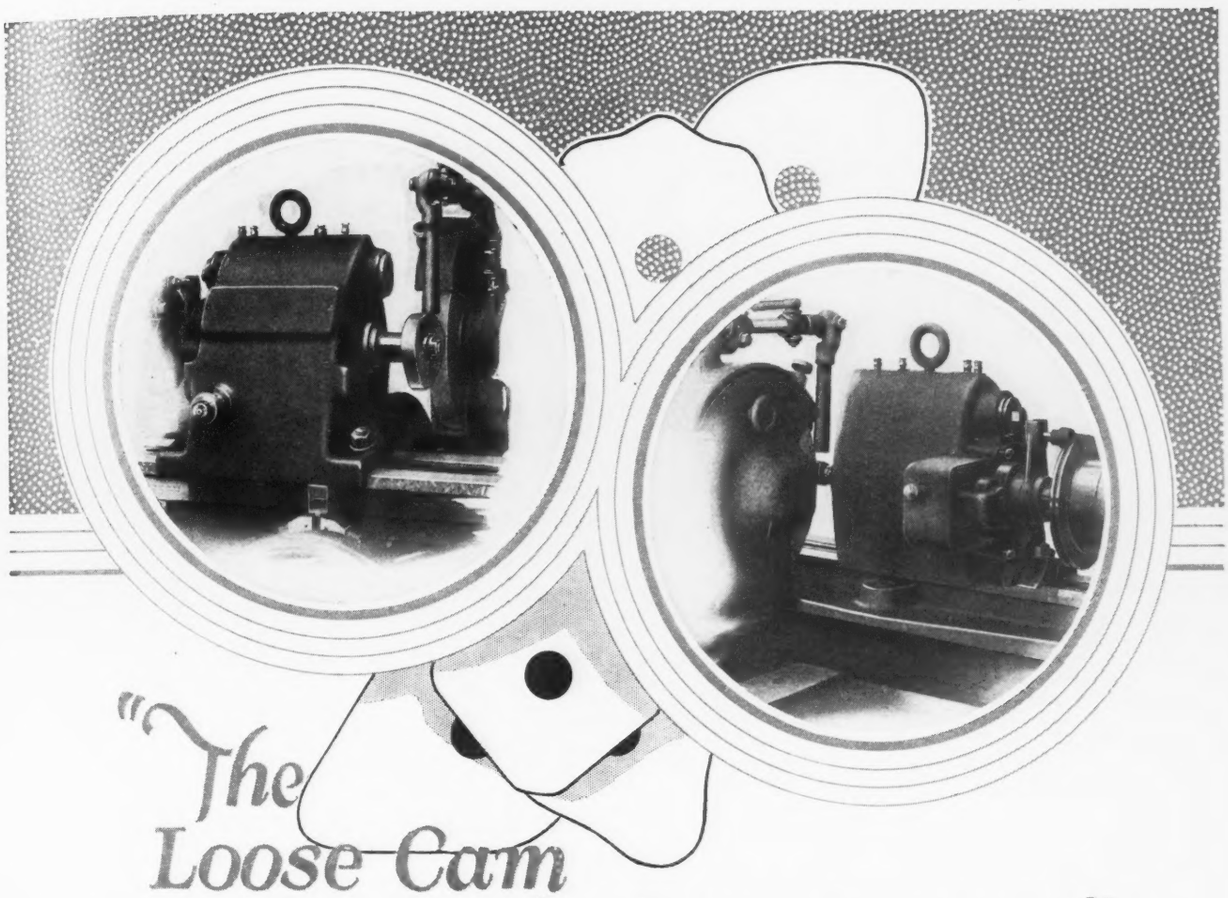
Fitchburg Grinding Machine Corp.
Fitchburg, Mass.

Abolish Expensive Hand Finishing
with a

Simplex-A Abrasive Band Grinder

This grinder accelerates production and cuts costs. Hand emerying or filing operations are antiquated in comparison. The use of this new modern machine assures straight grain finishes with sharp edges. Details of this and other styles and sizes on request.

WALLS SALES CORP., 96 Warren St., New York



"The Loose Cam Grinding Attachment"

If you are a manufacturer of loose cams here is an attachment you will find almost indispensable.

It may be used in connection with both the Landis Plain and Universal machines. Two sizes may be had; one for the smaller sized cams, the other for cams of considerable size and weight. The design is such that cams of practically any shape may be ground on a production basis within close limits of accuracy.

Ask us for a descriptive circular.

LANDIS TOOL COMPANY
Waynesboro, Pa. U.S.A.

Detroit Chicago New York Philadelphia

If You Polish Cylindrical Parts

you should know about Production Polishing and Finishing Machines—the remarkably simple and low cost method of polishing and finishing cylindrical and tapered work from ¼″ to 6″ diameter in wood, metal, bakelite, etc.

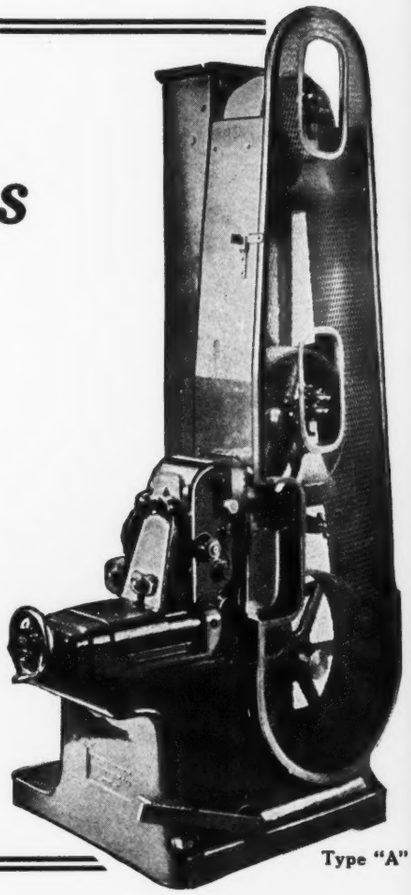
Feed is centerless—no chucking or setting up; a moving belt carries the work across the polishing belt in line contact. The grade of polishing belt controls the degree of finish. Adjustments for varying diameters are quickly and easily made.

Send for details of this machine.

PRODUCTION MACHINE COMPANY

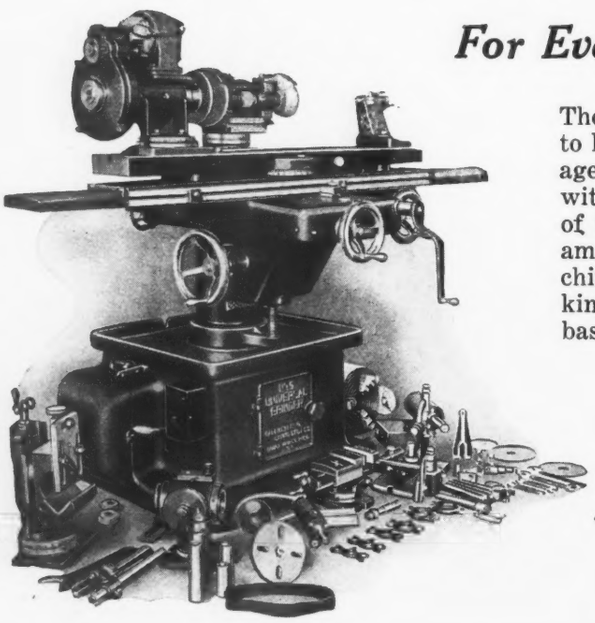
GREENFIELD, MASS., U. S. A.

Motch & Merryweather Machinery Co., Cleveland, Pittsburgh, Cincinnati.
P. A. Koerber, 565 W. Washington St., Chicago, Ill.
The Chas. A. Strelinger Co., Detroit.



Type "A"

The Grand Rapids No. 5 Universal Grinder



For Every Grinding Job in Your Shop

The Grand Rapids No. 5 Tool and Cutter Grinder is built to handle every grinding job, large or small, in the average shop. Its wide range includes wet and dry grinding, with or without power feed. A big, roomy table, plenty of power, and unusual capacity for precision work are among the outstanding features of this economical machine. Comes fully equipped with attachments for all kinds of work—and *does* it on a surprisingly low cost basis. Write for complete description.

Grand Rapids No. 5 Universal Tool and Cutter Grinder

Maximum Swing Between Centers (Reamer Grinding)	10½″ x 42″
Maximum Swing Between Centers (Cylindrical Grinding)	10½″ x 38″
Longitudinal Travel	32″
Transverse Movement	10″
Vertical Movement	10¾″
Size of Table	6″ x 50″

Write for further details of this and other grinders.

GALLMEYER & LIVINGSTON COMPANY

344 Straight Ave., S. W., Grand Rapids, Mich.

Export Dept.—233 Broadway, New York City

ENDURO NIROSTA

LIGHTING the WAY to NEW ACHIEVEMENTS

—a new alloy—with entirely new properties and a myriad of uses, is lighting the way to new achievements in American Industry.

Its name is Enduro-Nirosta, an austenitic steel with the ductility of copper; it can be deep drawn, wire drawn and spun—easily welded by gas or electric methods, and readily machined.

It can be polished to a mirror surface and is resistant to acid and salt corrosion at high temperatures without loss of strength.

This alloy, new to America, is already in use in a score of industries—and has been used in thousands of applications abroad. It is now produced by Ludlum Steel Company under American license rights to the patented method of processing.

WHERE CAN YOU USE THIS NEW ALLOY STEEL?

It is coming fast—wherever heat—or corrosion—resistance or finish, are important factors.

A letter will bring a copy of the new Enduro Nirosta Booklet, with suggestions for its application in your work.

SEND FOR THE NEW ENDURO NIROSTA BOOKLET

VISIT THE ENDURO NIROSTA EXHIBIT
N. Y. CENTRAL BUILDING
26TH FLOOR · NEW YORK

LUDLUM

LUDLUM STEEL COMPANY
WATERVLIET AND DUNKIRK, N. Y.
NITRALLOY, STRAUSS METAL
TOOL & ENDURO NIROSTA STEELS

LUDLUM

SPECIALIZING ON SPECIAL STEELS

Constant research, the consulting services of world-renowned metallurgists, initiative in production under the most recent developments on two continents — all mark Ludlum's progress in leading the way in economy of production and quality of product throughout Industry.

All Ludlum Steels are made in electric furnaces—they are consistent, each true to its standard of analysis and tests. Consistency is an important factor when you select the steel for your needs. It assures you of an even production and reliability in service.

Tool steel, die steel, drill rods, forgings, wire, valve steel, Strauss Metal (tungsten carbide)—Nitralloy—and Enduro Nirosta; among these Ludlum brands you will find a special steel for your special requirement.

There is only one correct steel for each individual purpose. The Ludlum representative in your locality is a trained consultant; he will be glad to work with your own specialists in the selection of the proper steels for your problems.

A request to place your name on our mailing list will assure the receipt of all new information.

LUDLUM STEEL COMPANY
NITRALLOY, STRAUSS METAL

WATERVLIET AND DUNKIRK, NEW YORK
TOOL & ENDURO NIROSTA STEELS

LUDLUM STEEL COMPANY

2976

DLUM STEEL CO.
tervliet, N.Y.

ase send me your latest informa-
n on
Enduro-Nirosta Steels
Nitralloy and Nitriding
Die Steels
Tool Steels
Strauss Metal (Tungsten Carbide)

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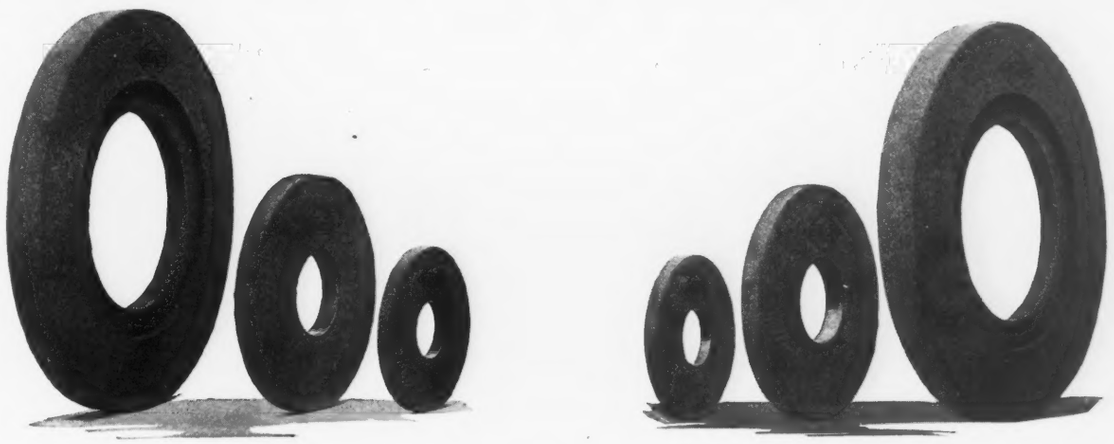
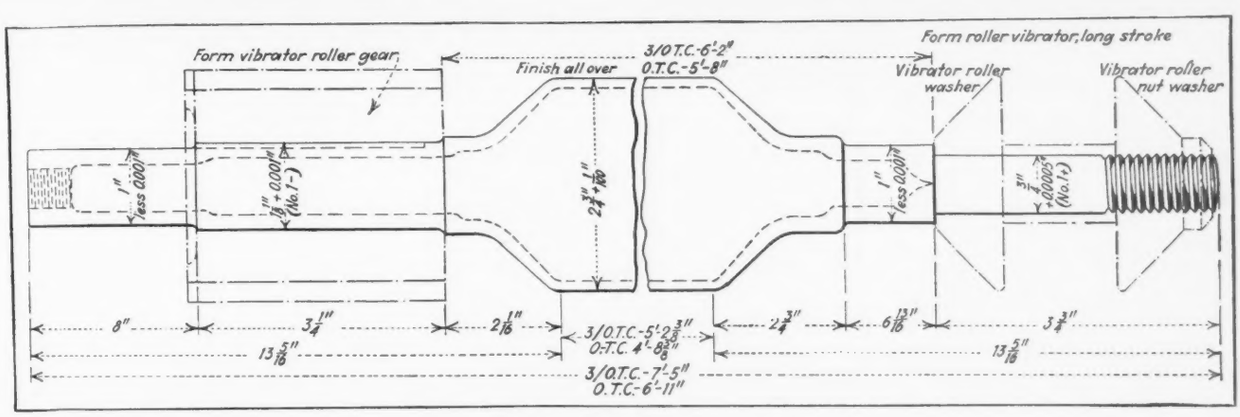
GRIND WITH ABRASIVE WHEELS





Production grinding *reduces costs*

From an article recently prepared from data given to the editor of "American Machinist" by the Miehle Printing Press and Manufacturing Company, the following is an excerpt:

"The modern grinding machine is much more efficient than its predecessors. For grinding relatively long rollers the new machine reduces the cost as much as 50 per cent.

"The illustration shows a form vibrator roller about 7 ft. long. Note that the horizontal dimensions are not to scale. Modern grinding wheels and equipment have reduced the time required from 155 hours per hundred pieces to 75 hours."

This particular case of cylindrical grinding is typical of what modern grinding methods are doing in many industrial plants when applied to production grinding.

Let an Abrasive Engineer solve your grinding problems. No obligation is incurred.

TRADE ABRASIVE MARK

ABRASIVE COMPANY

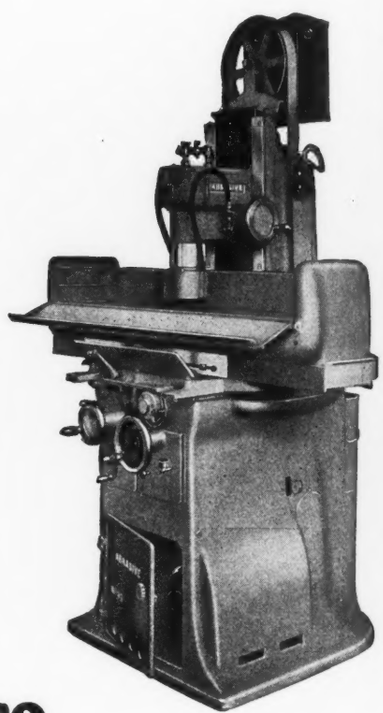
DIVISION OF SIMONDS SAW AND STEEL COMPANY

Tacony and Fraley Streets

Detroit PHILADELPHIA Chicago

ABRASIVE

No. 33 VERTICAL SPINDLE SURFACE GRINDER



There are many flat grinding jobs that can be done in this machine with a tremendous saving in time over ordinary methods.

Let us explain how you can take advantage of these savings.

Drawings or samples sent to us will bring an immediate report.

ABRASIVE MACHINE TOOL CO.
EAST PROVIDENCE, R. I.

ACCURACY

TYPE F1U (110-220-volt universal)
"Ideal" Portable Electric Lathe Center Grinder

Through combining speed with accuracy, the Ideal Lathe Center Grinder provides a tool which pays for itself over and over in any shop. It will grind lathe centers to a 60-degree angle with mechanical accuracy in a fraction of the time required by any other method. It requires no adjustments, no trying, no gauging, no waste of time and inaccurate results. It is not necessary to disturb your toolpost set-up to use this tool.

Write for Particulars Today

DRILLS — SCREWDRIVERS — GRINDERS

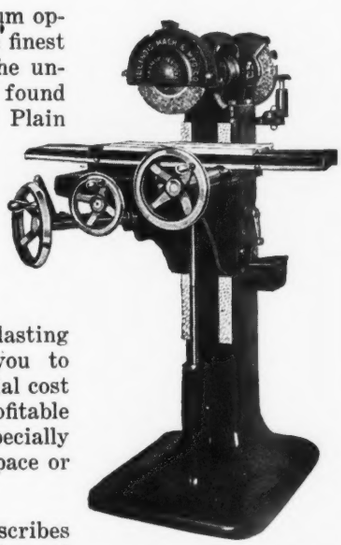
The Schauer Machine Company
905-907 Broadway, CINCINNATI, OHIO, U. S. A.

A Moderately Priced
Plain and Surface Grinder

Low initial cost, minimum operating charges and the finest work possible—that's the unbeatable combination found in the Illinois No. 11 Plain and Surface Grinder.

Unsurpassed operating convenience is a primary feature of this compact grinder —one end is for plain the other for surface grinding. The sturdy, lasting construction enables you to write off the small initial cost over many years of profitable service. Designed especially for shops where floor space or output is limited.

Our latest Bulletin describes this machine completely and shows cross section of head and countershaft. May we send a copy?



Illinois No. 11 Plain and Surface Grinder. Wheels are 8" x 1" x ¾". Maximum distance, wheel to table—11". Working surface 24" x 6". Spindle runs in Timken tapered roller bearings.

Illinois Machine & Mfg. Co., La Salle, Ill.

ILLINOIS GRINDERS

Let Facts and Figures Rule

Regardless of sales talk, advertising or anything else the solid fact remains that it is facts and figures that tell the story.

Every Sterling grinding engineer has an abundance of fact and figure evidence of the more and better grinding results that have been obtained by Sterling grinding wheels, and these are not isolated instances. They are consistent records obtained in dozens of plants on different kinds of work.

No matter what your previous conception of grinding results, it is a good idea to call in a Sterling grinding engineer and compare results. Find out the newest data on grinding. Let facts and figures rule.

THE STERLING GRINDING WHEEL CO.

Abrasive Division of The Cleveland Quarries Co.

Factory and Office, Tiffin, Ohio. Branch at 23 S. Jefferson St., Chicago.

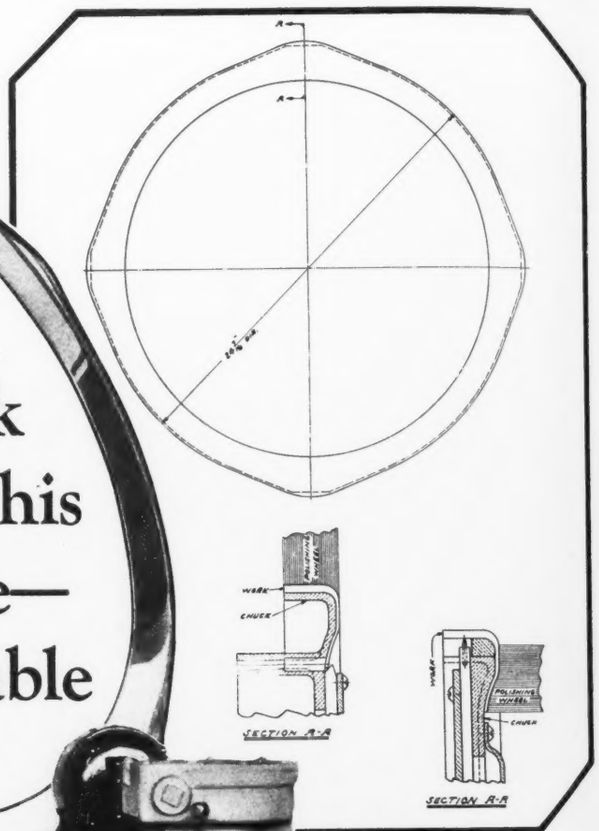
Grinding Wheel Distributors

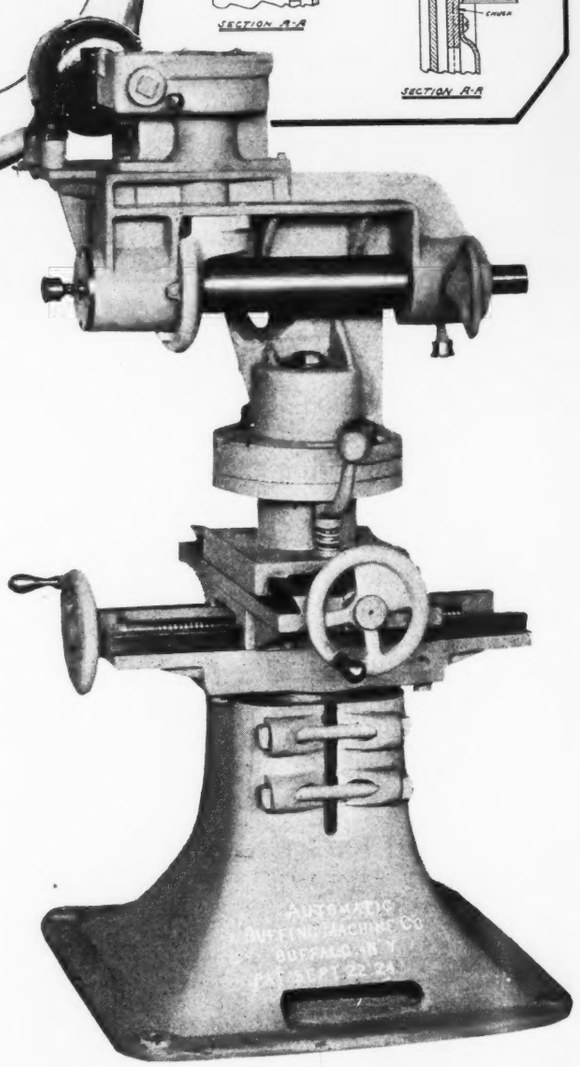
NEW YORK — 30 West Broadway, L. Best Co., Inc.
BEDFORD, IND. — Quinn Plumbing Co.
BOSTON — Winter Hill Sta., Lombard & Co. (also grindstones)
CANTON — The Canton Hardware Co.
CHICAGO—23 S. Jefferson St., The Sterling Grinding Wheel Co.
CINCINNATI — The Wm. T. Johnston Co.
CLEVELAND—The W. M. Pattison Supply Co.
DETROIT — 5187 Loraine Ave. G. L. Dunfee.
ELMIRA—Irving D. Booth, Inc.
ERIE—United Hardware & Supply Co.
LOUISVILLE — Belknap Hardware & Mfg. Co.
MILWAUKEE — Ph. Gross Hardware & Supply Co.
MINNEAPOLIS, MINN.—Hennepin Hardware Co.
PITTSBURGH—Pittsburgh Gage & Supply Co.
ST. LOUIS—St. Louis Machinists' Supply Co.
WATERTOWN, N. Y.—W. W. Conde Hardware Co.
YOUNGSTOWN, O.—The Stambaugh-Thompson Co.

STERLING ABRASIVES

AND STERLING GRINDING MACHINES

We Specially Designed the Geared Chuck That Makes This Job Possible—and Profitable





The part, a cast aluminum ring for a washing machine top, is 24-7/16" in diameter and irregular in shape. To buff it we recommended our type 45 machine equipped with a special geared chuck designed in our engineering department.

The rings are polished in two operations and buffed in two operations, with one man operating two Automatic Buffing Machines.

Production per operator is 60 per hour in each case—about three times the average that could be expected by hand methods—and the work is more uniform than can be obtained by the best hand polishing on parts this size.

There are six Automatic Buffing Machines in the plant where this operation is performed—all of them getting wholly satisfactory results. By making an individual study of every production buffing problem, then suggesting—or developing—the correct machine and work holding equipment for each part, our engineers have made Automatic Buffing Machines pay on a remarkably wide range of large and small work.

The Automatic Buffing Booklet shows applications, quotes production figures. Study it—then ask our production engineers to help to solve your problems in this field.

Automatic Buffing Machine Company

Chicago and Perry Sts., BUFFALO, N. Y.

Automatic Buffing Machines

The Bearings Co. of America Praises Blanchard Grinders

High Accuracy and Excellent Production Sustained on Thrust Washers and Annular Bearing Rings

The Bearings Company of America, Lancaster, Pa., is a large and satisfied user of Blanchard Grinding Machines. Twelve of these tools are installed in this plant, and they have established an enviable record for accurate and fast grinding on important parts over a ten-year period.

For best results, use Wheels and Segments made by Blanchard

The operation shown is on thrust washers and annular bearing rings. These parts are ground on both sides, .017″ stock being removed from either side of the washers—.006″ from the rings. Production on the former job ranges between 450 and 500 parts, and on the latter from 500 to 550. Accuracy is held to a limit of .0005″.

This battery of Blanchard Grinders is in operation 67 hours per week, and the owners say they are ideally suited to this type of work—a testimonial well certified by the size of the installation.

Let us show you how Blanchard Grinding can show equally fine results on *your* grinding work.

See the Blanchard exhibit at National Tool Exposition, Cleveland, Sept. 30-Oct. 4.

The Blanchard Machine Company, 64 State St., Cambridge, Mass.

DEALERS:

UNITED STATES—Henry Prentiss & Co., Inc.; Motch & Merryweather Machinery Co.; Marshall & Huschart Machinery Co.; W. E. Shipley Machinery Co.; Kemp Machinery Co.; Marshall & Huschart Machinery Co. of Indiana; Elliott & Stephens Machinery Co.; Robinson, Cary & Sands Co.; Harron, Rickard & McCone Co.; The Hendrie & Bolthoff Mfg. & Supply Co.; Huey & Philp Hardware Co.; Woodward, Wight & Co., Ltd.
CANADA—Williams & Wilson, Ltd.; F. F. Barber Machinery Co. GREAT BRITAIN and IRELAND—Burton, Griffiths & Co., Ltd. FRANCE—Aux Forges de Vulcain. SWEDEN—Maskinaktiebolaget, Karlebo. JAPAN—Andrews & George Co. CZECHOSLOVAKIA, AUSTRIA and HUNGARY—Ing. M. Kocian & G. Nedela. GERMANY—Schuchardt & Schutte A. G. SOUTH AFRICA—D. Drury & Co., Ltd. HOLLAND, BELGIUM and COLONIES—R. S. Stokvis & Zonen. SWITZERLAND—C. Schinz & Co.

Our machines are properly designed and built for long and continuous service.

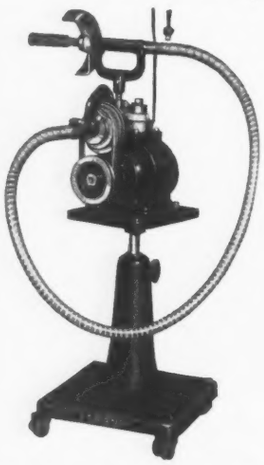
Strand
FLEXIBLE SHAFTS

Twenty-four years' successful manufacturing of Flexible Shafts.

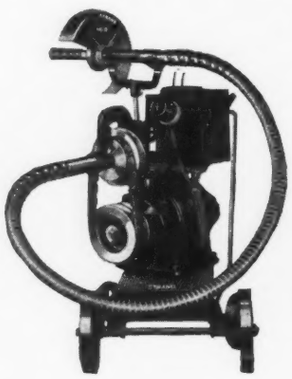
Established 1905

The tremendous demand for "Strand" flexible shaft equipment and "Strand" flexible shafts, after a period of twenty-four years, demonstrates clearly the high regard thousands of users, all over the world, have for our products.

When a flexible shaft is stamped—"Strand"—it is made by "Strand"—and therefore our guarantee stands back of it. We build many types and sizes of flexible shaft equipments for many purposes. *Send for Complete Catalog.*



We Originate, Design and Build



We are Proud of the Long List of Users and Representative Machinery and Supply Houses offering the "Strand" Products in this Country and Abroad

Manufactured By

N. A. STRAND & COMPANY

Factory and General Offices:
5001-09 No. Lincoln St., CHICAGO

THE KELLERFLEX

A Flexible Shaft Machine of a Hundred Uses. Made in various sizes and types to meet every requirement.

Speeds from 875 to 10,500 R. P. M.

For Snagging, Burring, Lapping, Buffing, Polishing, Sanding, Drilling, Wire-Brushing, etc.

Non-Heating Shaft
Ball Bearing Handpiece
Ball Bearing Motor
Universal Swivel

COMPLETE LINE OF ACCESSORIES

Rotary Files
Sanding Drums
Emery Wheels
Wire Brushes
Polishers, etc.

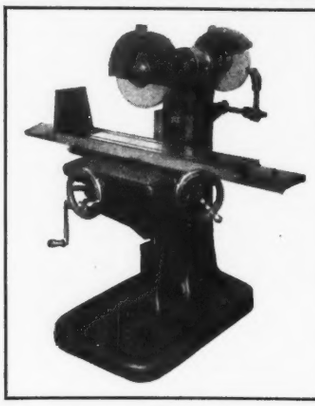
Rotary Files — 27 Shapes

Write us to-day for list of users in your line of manufacture

Sanding Drums

Wire Brushes

Keller Mechanical KE Engineering Corp.
74 Washington Street BROOKLYN, N. Y.



LA SALLE No. 3 SURFACE AND PLAIN GRINDER or SURFACE ONLY

DRY OR WET

This machine tool is designed for general shop and tool room use, and ably meets the requirements of a rigid and accurate Grinder at a reasonable price.

The Spindle is of ample size, is accurately ground and is mounted in bronze Bearings of our own special alloy. Each Bearing has a large oil reservoir and felt oilers, insuring constant lubrication.

The longitudinal movement is operated by a spiral gear and rack, providing smooth movement, which insures uniform cutting. The feed is by hand. Traverse movement is screw and nut, with a generous hand wheel.

Vertical movement of the table is by means of a screw and bronze nut and is provided with a dial having graduations which reads in .001".

The table has two "T" slots.

All Bearing surfaces are hand scraped to masters and are suitably guarded against dust and grit.

This Grinder is furnished either with both surface and plain ends or with a surface grinding wheel only. Countershaft is furnished with both styles.

LA SALLE TOOL CO., OTTAWA, ILL.

for GRINDING THE HARDEST METALS Industry has *Ever* Known

Carborundum

REG. U.S. PAT. OFF.

THESE new metals that seem destined to revolutionize certain applications of cutting tools—metals that cost nearly as much as platinum and almost twice the price of gold—have presented a new grinding problem that has been solved by Carborundum.

¶To users of Carboloy, Widia, Hartmetal, Miramant, Dynit, Diamondite, Duridium and similar metals we give the welcome news that we have a Carborundum Wheel which after exhaustive tests proves its ability to properly grind these new creations of the metallurgist.

¶It's a wheel that will penetrate—that is of just the proper grade and grit to quickly bring these tools to an edge.

¶For finishing, we recommend hand stoning with Carborundum stones developed for this work. Stoning gives the tool a proper keen-cutting edge, free from grinding marks.

[*Glad to consult with you in the matter of grinding these "precious" metals of industry*]

THE CARBORUNDUM COMPANY, NIAGARA FALLS, N. Y.

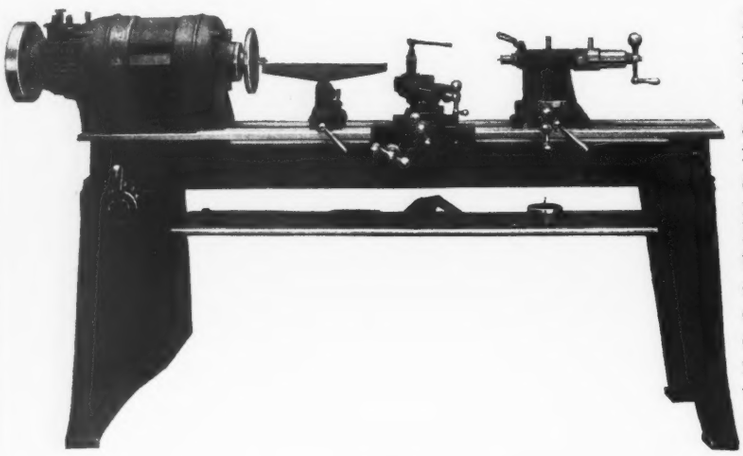
CANADIAN CARBORUNDUM CO., LTD., NIAGARA FALLS, ONT.

SALES OFFICES AND WAREHOUSES IN New York : Chicago : Boston : Philadelphia : Cleveland
Detroit : Cincinnati : Pittsburgh : Milwaukee : Grand Rapids
The Carborundum Co., Ltd., Manchester, England
Deutsche Carborundum Werke, Dusseldorf, Germany

(Carborundum is the Registered Trade Mark of The Carborundum Company for its products)

Announcing!

THE NEW "Blount" 16" Multi-Speed Pattern Maker's Lathe



For the modern pattern shop the new Blount 2 HP 8-speed Motor Headstock Lathe is indispensable. Increased production and marked economy in operation are assured. The headstock is fully enclosed. Main spindle has 4 speeds, 600—3600 rpm, while by gear reduction the rear spindle runs at half speed, permitting large diameter turning. Controller and all parts are easily accessible, making production easy and rapid. Simple and sturdy in construction, this lathe achieves marked economies in operation, maintenance and production costs.

Modernize your pattern shop with Blount Multi-speed Pattern Maker's Lathes.

Descriptive bulletin on request.

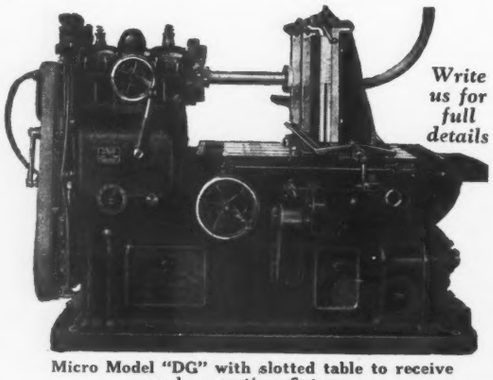
J. G. BLOUNT COMPANY, Everett, Mass.

GRINDERS Micro

Designed to Fit Your Work

In a number of the country's largest industrial machine shops, many grinding problems of the most perplexing nature have been successfully solved with the installation of MICRO Internal Grinders.

Whatever the nature of *your* work—if it involves internal grinding with emphasis on *Speed—Accuracy—Economy*—then you will do well to let Micro engineers study your conditions and make recommendations.



Write us for full details

Micro Model "DG" with slotted table to receive work mounting fixtures.

MICRO MACHINE COMPANY

Bettendorf — MANUFACTURERS AND DESIGNERS OF PRECISION GRINDERS FOR ALL PURPOSES — Iowa, U-S-A

Grinding Wheel Dressers

The Desmond Diamo-Carbo Dresser

The best all-around Tool Room Dresser. The steel tube is filled with an extremely hard abrasive which is very durable and economical.

Desmond-Stephan Mfg. Co., Urbana, Ohio

Canadian Desmond-Stephan Mfg. Co., Ltd., Hamilton, Ontario.

Lapointe Broaching Equipment

We specialize in fine broaches and broaching equipment—powerful, rugged tools that deliver highly efficient service with minimum power and labor consumption. Confer with our engineers on your broaching problems. Catalog on request.

The Lapointe Machine Tool Co.
Hudson, Mass., U. S. A.

Hisey

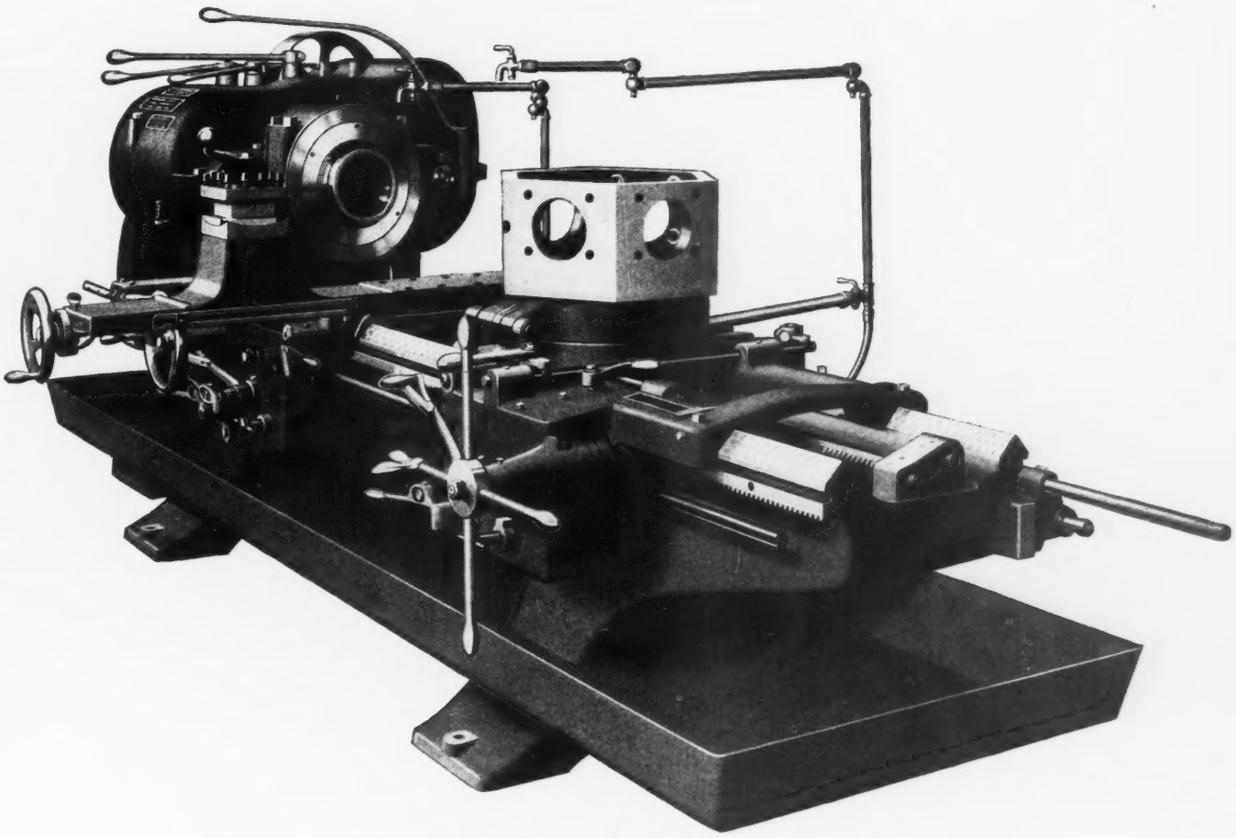
ELECTRIC DRILLS GRINDERS, BUFFERS

Hisey electric tools win by comparison. Write for catalog 40 M.

The Hisey-Wolf Machine Co.
Cincinnati, Ohio

FOSTER

Universal Turret Lathes and Screw Machines



The Foster B-Type Universal Turret Lathe Built in Three Sizes

Timken Bearing Spindles — Ball Bearing Intermediate Shafts — Multiple Disc Clutches—mean for the user prolonged endurance, greater accuracy, lower power costs.

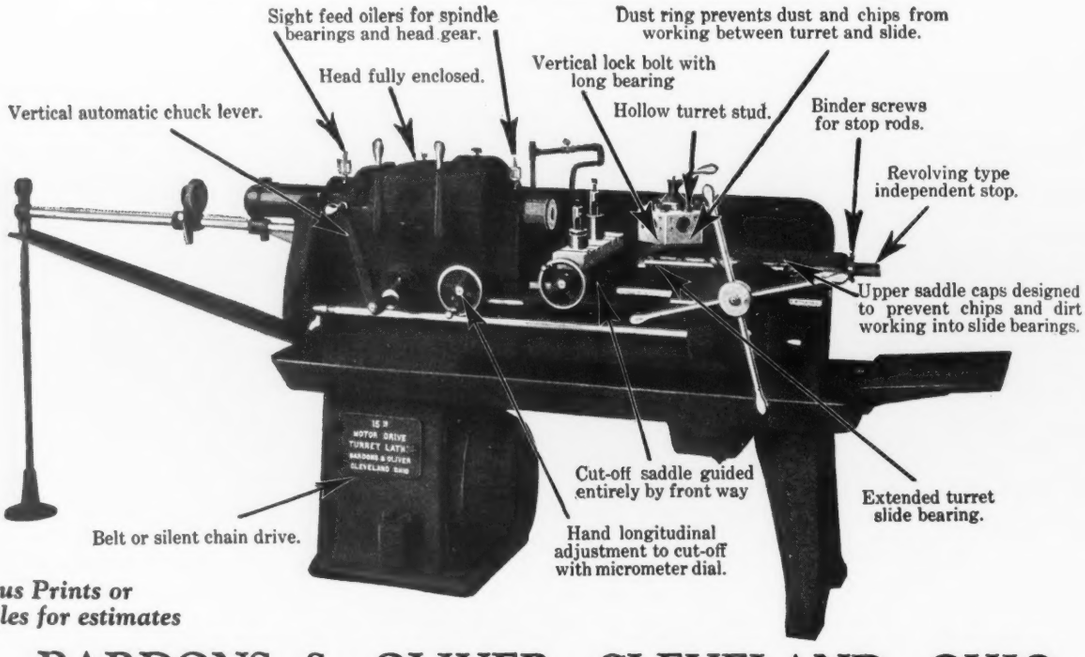
Productivity and production cost per piece depend largely on the character of your work. Samples or blue prints of your work will enable us to give you Foster figures. Foster Machines and Foster Methods have effected great savings on the simplest work as well as the most complicated. It will pay to investigate.

FOSTER MACHINE COMPANY

ELKHART, INDIANA

Motor Driven Turret Lathes — New Models

SIZES—13/16 to 2 in. Automatic Chuck Capacity
13 in. to 18 in. Swing for Chucking Work
Power Cross Feed or Cam Operated Cut Off Rest if required


Sight feed oilers for spindle bearings and head gear.
Dust ring prevents dust and chips from working between turret and slide.
Head fully enclosed.
Vertical lock bolt with long bearing
Vertical automatic chuck lever.
Hollow turret stud.
Binder screws for stop rods.
Revolving type independent stop.
Upper saddle caps designed to prevent chips and dirt working into slide bearings.
Cut-off saddle guided entirely by front way
Extended turret slide bearing.
Belt or silent chain drive.
Hand longitudinal adjustment to cut-off with micrometer dial.

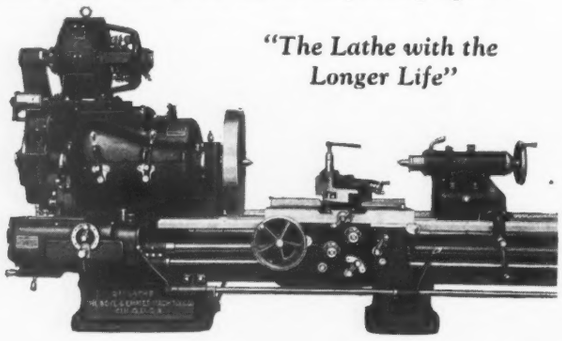
Send us Prints or Samples for estimates

BARDONS & OLIVER, CLEVELAND, OHIO

CONELESS [Geared Head]

TRADE MARK REG.

Initial Driving Friction is cast iron, expanding part of large diameter and wide face with long hub, on which is mounted an adjusting spool with hardened tool steel key, making a self-contained unit and relieving shaft of all strain and sliding friction members. Overcomes any tendency of friction to tilt, thereby maintaining friction members in full width contact. Friction is easily adjusted from one point readily accessible. Adjusting screw should be set up one quarter turn at a time and then tried before adjusting again.



"The Lathe with the Longer Life"

Profits as Wide as the Range

No turning equipment in its class excels the Coneless 27″—and none returns more liberal profits on every job in its cycle of talents.

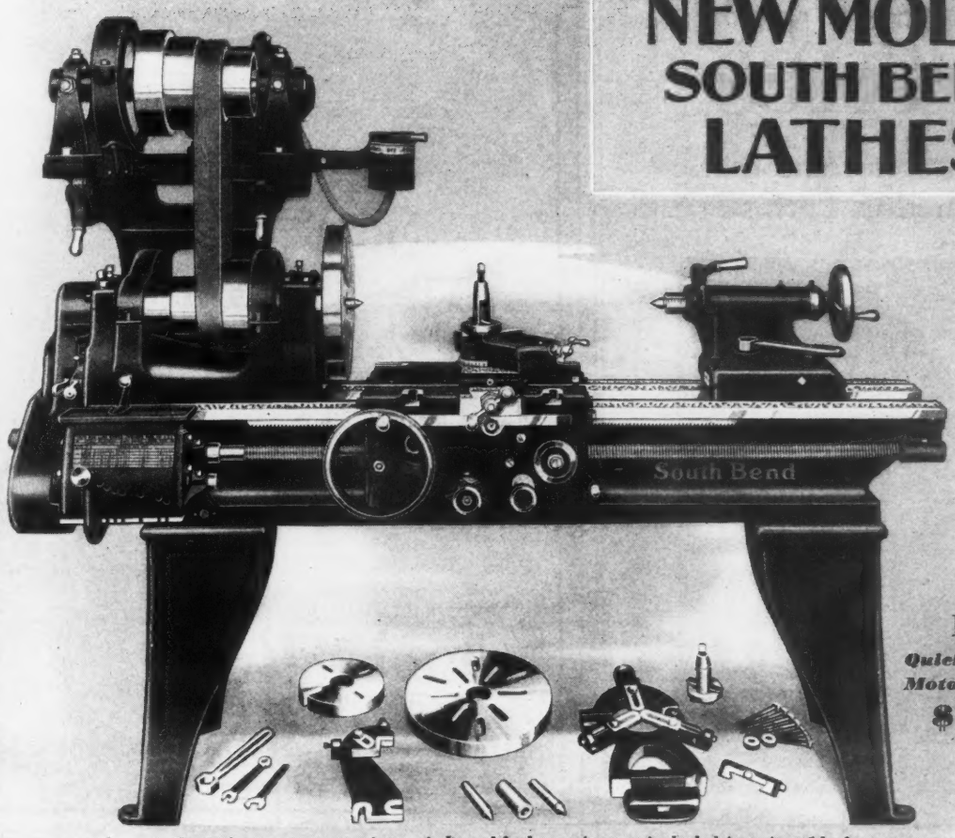
Greater care in construction, added quality of the building materials and a peerless array of construction and operating features are three reasons why the Coneless 27″ continues to set the pace on tool-room and production turning.

Write to us for complete details.

THE BOYE & EMMES MACHINE TOOL CO.

CINCINNATI, OHIO, U. S. A.

NEW MODEL SOUTH BEND LATHES



16″ x 6′
Quick Change Gear Motor Driven Lathe
$777

Reversing motor, reversing switch and lathe equipment included in price of lathe

South Bend New Model Lathes are built in 96 sizes and types from 9″ swing to 18″ swing inclusive, with 3′ to 12′ bed lengths in various patterns listed below:

Countershaft Driven Lathes
Motor Driven Lathes
Quick Change Gear Lathes
Standard Change Gear Lathes
Tool Room Lathes
Gap Bed Lathes
Brake Drum Lathes
Bench Lathes

Write for new Catalog No. 90-A, illustrating, describing and pricing the complete line of New Model South Bend Lathes. A copy will be mailed free on request.

The South Bend Lathe Works is represented by prominent machinery dealers and importers in the leading cities of the world. Most representatives carry South Bend Lathes in stock where they may be seen and examined.

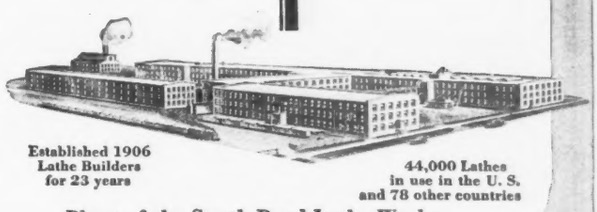
South Bend Lathe Works

765 East Madison Street
South Bend, Indiana, U. S. A.

For Manufacturing, Production and the Tool Room

A Few Recent Purchasers

Sinclair Refining Co.
Olds Motor Works
Nicholson File Co.
American Nickel Corporation
Carborundum Company
Radio Corporation of America
American Telephone and Telegraph Co.
Pratt and Whitney Aircraft Co.
United Shoe Machinery Corp.
Rolls-Royce of America
Premier Adding Machine Co.
Sparks-Withington Co.



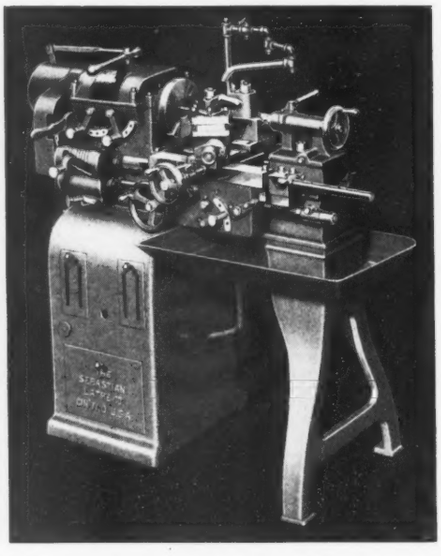
Established 1906
Lathe Builders
for 23 years

44,000 Lathes
in use in the U. S.
and 78 other countries

Plant of the South Bend Lathe Works

SEBASTIAN LATHES

11" Swing Semi-Automatic Production Lathe



The Diameter and Length Gauges featured on this machine are indispensable on duplicate work. One piece only has to be made; the bar and wheels are then notched to conform with the finished sizes of your piece, and the "setting-up" is completed. After the job is run off the gauges are removed until the same job comes up again.

A Small, Speedy Lathe For Machining Small Multiple Diameter Pieces

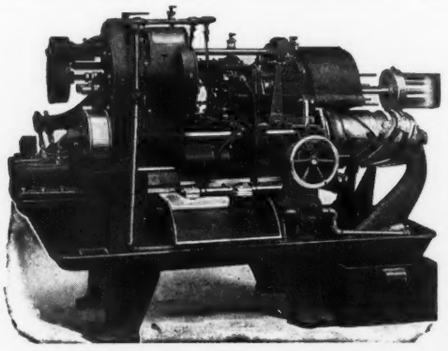
No other lathe is like the Sebastian; few offer the combination of advantages. The 11" Gold Seal couples small size with a range and speed usually found only in high priced equipment.

This lathe is aligned to an accuracy of .0005"—plenty of weight, steel gears, and oversize bearings keep them that way and insure precision work. Its capacity is remarkable: spindle has a 1-15/16" hole and collets up to a size equal to the average 14" lathe can be accommodated. Write for complete description.

THE SEBASTIAN LATHE COMPANY

106 Culvert Street Cincinnati, Ohio

NEW YORK ADDRESS: Room 372, 50 Church St.



The Ultimate in Automatics

Rapid set-up and easy tooling feature the Cincinnati 5-Spindle Automatic Screw Machine, and every facility for the proper tooling of every kind of screw machine work within liberal limits is provided for. Prominent among a wide range of features are these:

No designing of special cams.

Four cross slides for circular tools, making it possible to work nine tools at once.

Each cross slide universally adjusted with independent slides.

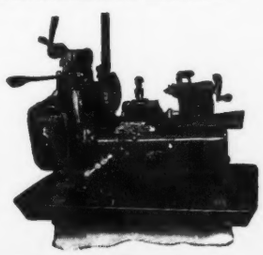
Each of nine tools has own cam.

Write us for all details.

Cincinnati Automatic Machine Co.
CINCINNATI, OHIO

RAPID PRODUCTION SMALL INVESTMENT

Porter-Cable Hi-Speed Production Lathe



THE PORTER-CABLE MACHINE CO.
Salina and Wolf Streets
Syracuse, N. Y., U. S. A.

Steinle Turret Machine Co.
THE FULL SWING SIDE CARRIAGE
TURRET LATHE
STEINLE TURRET MACHINE CO.
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FLATHER LATHES

HIGHEST GRADE FOR TOOL-ROOM AND MANUFACTURING PURPOSES

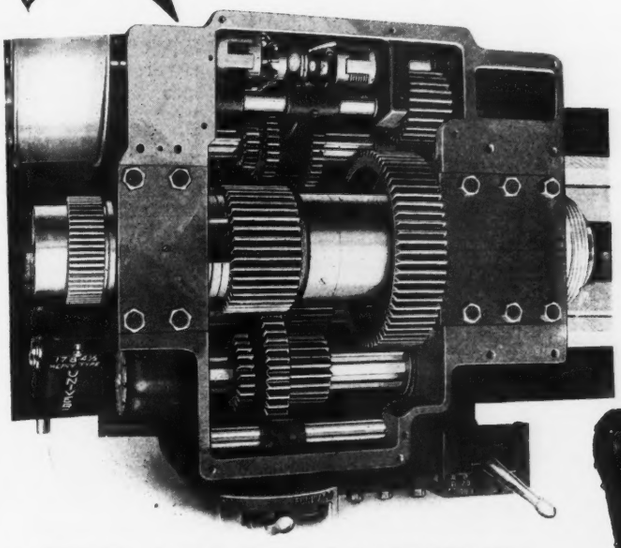
The Flather Company, Nashua, N. H.

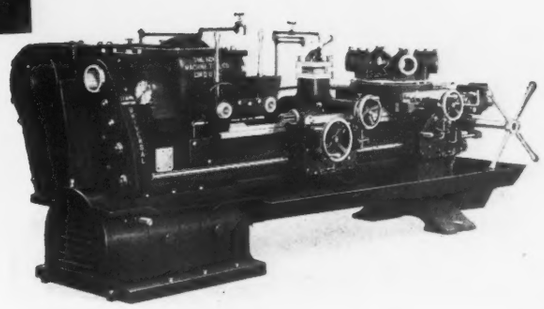
TRANSMISSION SHAFTS

OF

CINCINNATI ACME

17" & 4½" Universals
Mounted on
Roller Bearings





THE ACME MACHINE TOOL CO.

CINCINNATI OHIO, U. S. A.

"If It's Rivett, It's Right"

Versatile, Accurate, Powerful, Economical

Rivett BENCH LATHE

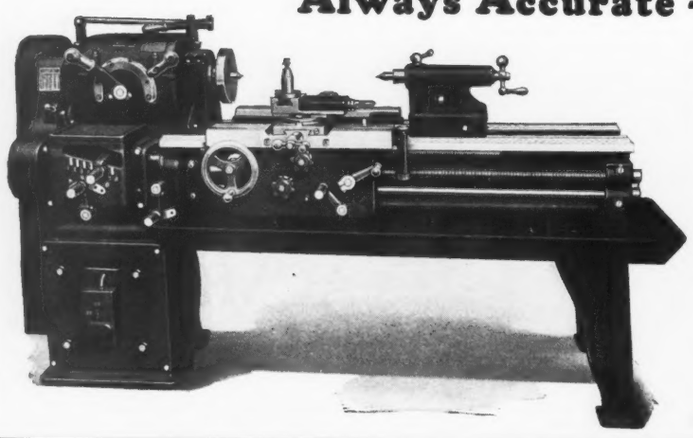
New Series No. 507

THE NEW RIVETT Series 507 Bench Lathe offers to the average bench lathe user whether for home mechanical uses, light manufacturing, or scientific or development work, the greatest value at a moderate price. The lathe and every item of its equipment represents the manufacturing efficiency made possible by complete modern tooling up. At a cost substantially less than any other high grade bench lathe it is a Rivett product worthy of the name.

Send for Bulletin and Hand Book No. 507-A and Price List No. 507-M

RIVETT LATHE AND GRINDER CORP.
BRIGHTON DISTRICT, BOSTON, MASS.

Always Accurate — Always Productive



Carroll & Jamieson 15" and 16" Lathes combine rocklike steadiness and dependability with flashing brilliancy on every kind of work. Neither quality is sacrificed to the other, and the result is a nicety of balance that produces work and profits in a volume to satisfy the most captious critic. Features include geared headstock, 12 spindle speeds, from 11½ to 393 R.P.M., special steel spindle, bronze bearings throughout, full lubrication and .0005" accuracy. Circulars on request.

THE CARROLL & JAMIESON MACHINE TOOL CO.
BATAVIA . . . . OHIO

THE HIGH SPEED RIVETING HAMMER

(Patented)

Nine sizes for cold riveting, 1/64 to 1/2 in. in diameter
Send riveting samples for demonstration
Write for Catalog "C"

THE HIGH SPEED HAMMER CO., Inc.
305-321 Norton St., ROCHESTER, N. Y., U. S. A.

CONE 4-SPINDLE AUTOMATICS

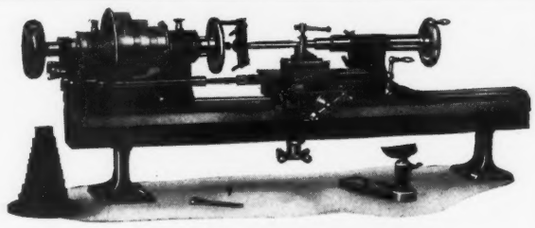
are economical and accurate producers of screw machine parts up to 4⅜" diameter 7" milling length.

They cut costs, increase production, boost profits. Write for particulars.

CONE AUTOMATIC MACHINE CO., Inc., Windsor, Vermont

REPRESENTATIVES:

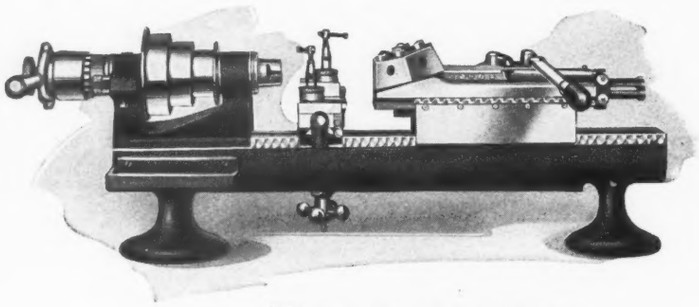
Detroit: J. C. Austerberry, 684 E. Congress St.
Chicago: John H. Glover, 2127 N. Sayre Ave.
Ohio: S. B. Martin, 1077 Erie Cliff Drive, Lakewood, O.
Indiana: G. A. Richey, Chamber of Commerce Bldg., Indianapolis.
Pennsylvania: Arch Machinery Co., 1005 Park Bldg., Pittsburgh, Pa.
New York State: Syracuse Supply Co., Syracuse, N. Y., Rochester, N. Y.
Philadelphia, Pa.: Lloyd & Arms, Inc., 133 South 36th St.
New England: Potter & Johnston Machine Co., Pawtucket, R. I.
California: C. F. Bulotti Machinery Co., 829-831 Folsom St., San Francisco, Calif.



Almost a Complete Machine Shop

An Elgin Precision Bench Lathe with attachments is capable of turning, boring, drilling, milling, sawing, slotting, shaping, grinding, etc. Excels larger tools on production, is unexcelled for precision. Details on request.

ELGIN TOOL WORKS, Inc. ELGIN, ILLINOIS



Write for Catalogue

Cataract

Bench Lathes
Precision Lathes
Millers, Attachments

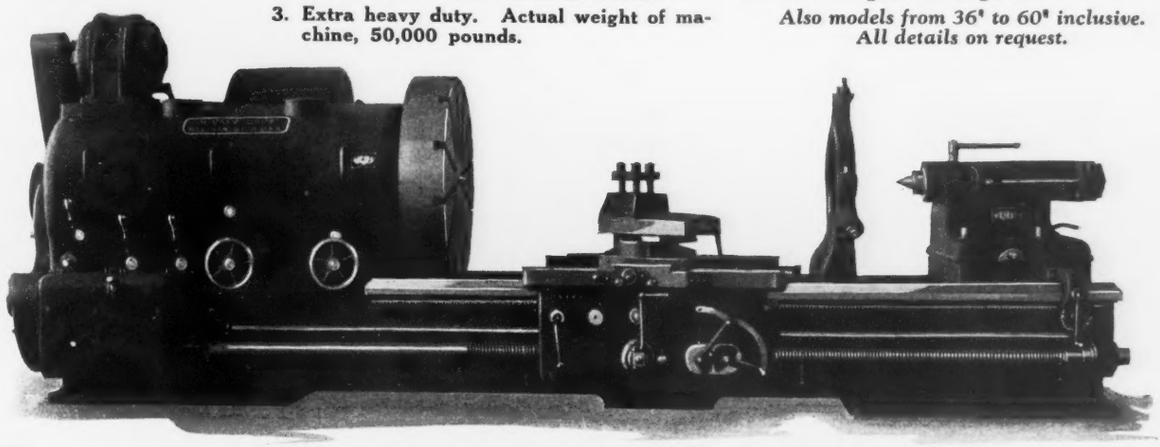
HARDINGE BROTHERS, Inc., 4149 Ravenswood Avenue, Chicago

50,000 Lbs. of Turning Efficiency

The Wickes 48″ Geared Head Engine Lathe is an entirely new machine, built to an entirely new design, incorporating a wide number of important features among which the following are outstanding:

1. Fully equipped with ball bearings and roller bearings throughout (excepting main spindle).
2. Force feed lubrication in headstock.
3. Extra heavy duty. Actual weight of machine, 50,000 pounds.
4. Has unusually wide range of speeds, both by direct face plate drive and by direct spindle drive.
5. All steel gears throughout.

Also models from 36′ to 60′ inclusive. All details on request.



EST. 1856

WICKES BROTHERS, Saginaw, Mich.

Builders of Heavy Duty Engine Lathes, Special Production Lathes and Crankshaft Turning Equipment, Heavy Duty Plate and Structural Tools, Blue Print Machines

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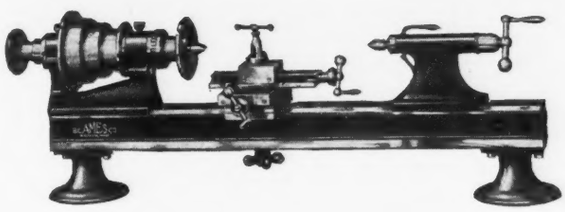
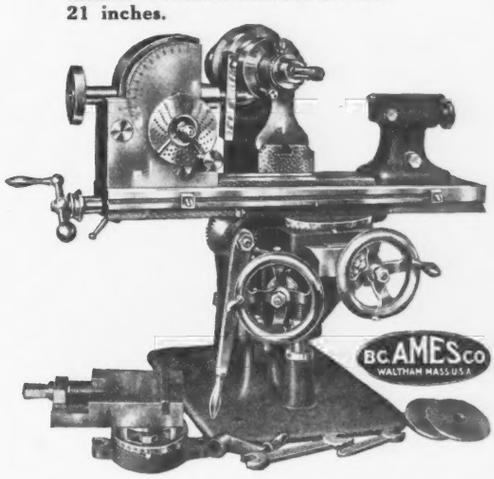
Ames Bench Lathes



For Turning—Drilling—Grinding—Milling—Threading—Filing—Polishing—in the tool room or in production.

Capacity: Bed—36 inches long with Back T. Slot. Headstock Capacity—either 5/8 inch or 1 inch. Swing over Bed—8 3/8 inches. Distance between Centers 21 inches.

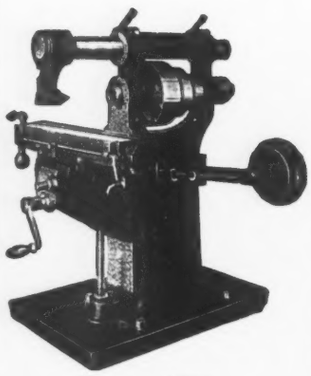


Ames Bench Millers

For the finest and most exacting precision milling in the tool room and in production. Liberal capacity for work of medium size—Sensitive and speedy in operation.

B. C. Ames Co., Waltham, Mass.

902 Stephenson Bldg. Detroit, Mich.



No. 4, $220

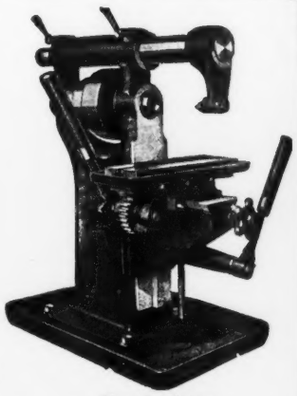
BURKE

Light Milling That Pays

It's poor economy to use heavy milling equipment on small work. Power cost is too high, and the production can never reach the speed necessary to effect profits. The Burke No. 3 and No. 4 Millers are ideal for work of this kind—low-priced, fast and accurate. They return their cost promptly in savings alone, and keep the big machines on work within range. *Ask us for the full details.*

THE BURKE MACHINE TOOL CO.

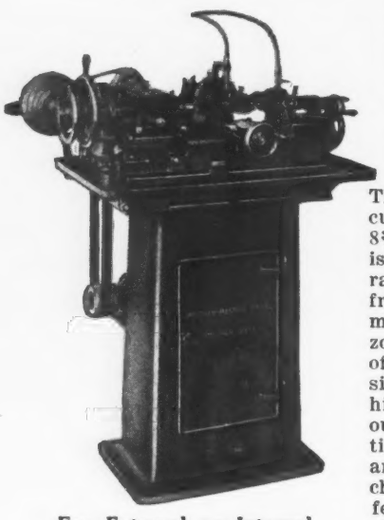
516 Sandusky St. Conneaut, Ohio, U. S. A.



No. 3, $155

WALTHAM
TRADE MARK
REGISTERED U.S. PAT. OFF.

DO YOU THREAD SMALL PARTS?



For External or Internal Threading on Small Parts

Put your small part threading on an economical production basis with a New Improved Waltham Thread Miller. Turn out parts 2" or less in diameter *accurately* and at top speed.

The New Waltham will cut a maximum thread of 8¾"—10" if spring chuck is used; cutter head range has been increased from 25° to 35° and head may be swivelled horizontally. A new system of distribution and disposition of coolant permits higher speed and greater output, while substantial time and labor savings are effected by the machine's semi-automatic feature, permitting *unskilled* operators to attain maximum machine efficiency.

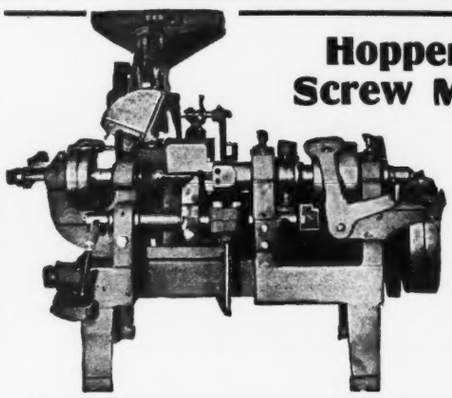
Write for details.

WALTHAM MACHINE WORKS

NEWTON STREET WALTHAM, MASS.

Makers of Small Thread Millers, Gear Cutters, and other Small Automatic Machines

Foreign Representatives: Buck & Hickman, Ltd., London. Fenwick Freres & Co., Paris. Andrews & George Co., Tokyo, Japan. Andrews & George Co., Seoul, Korea. Andrews & George Co., Dairen, Manchuria.



Hopper Feed Screw Machines

for any Metal Cutting Operation or any Blanks fed from Hopper or Magazine

H. P. TOWNSEND MANUFACTURING COMPANY

5 Chestnut Street HARTFORD, CONN.

U. S. HAND MILLERS

For all classes of light milling

U. S. SENSITIVE DRILLERS

For all classes of light drilling

SEND FOR CIRCULARS AND PRICES

United States Machine Tool Co. CINCINNATI, OHIO

Knight Millers

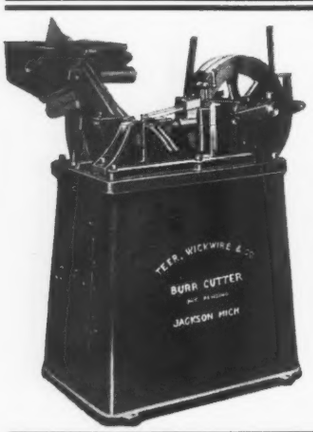
Versatile

and

Accurate

Send for information.

W. B. Knight Machinery Co. 3920 Pine Street St. Louis, Mo.



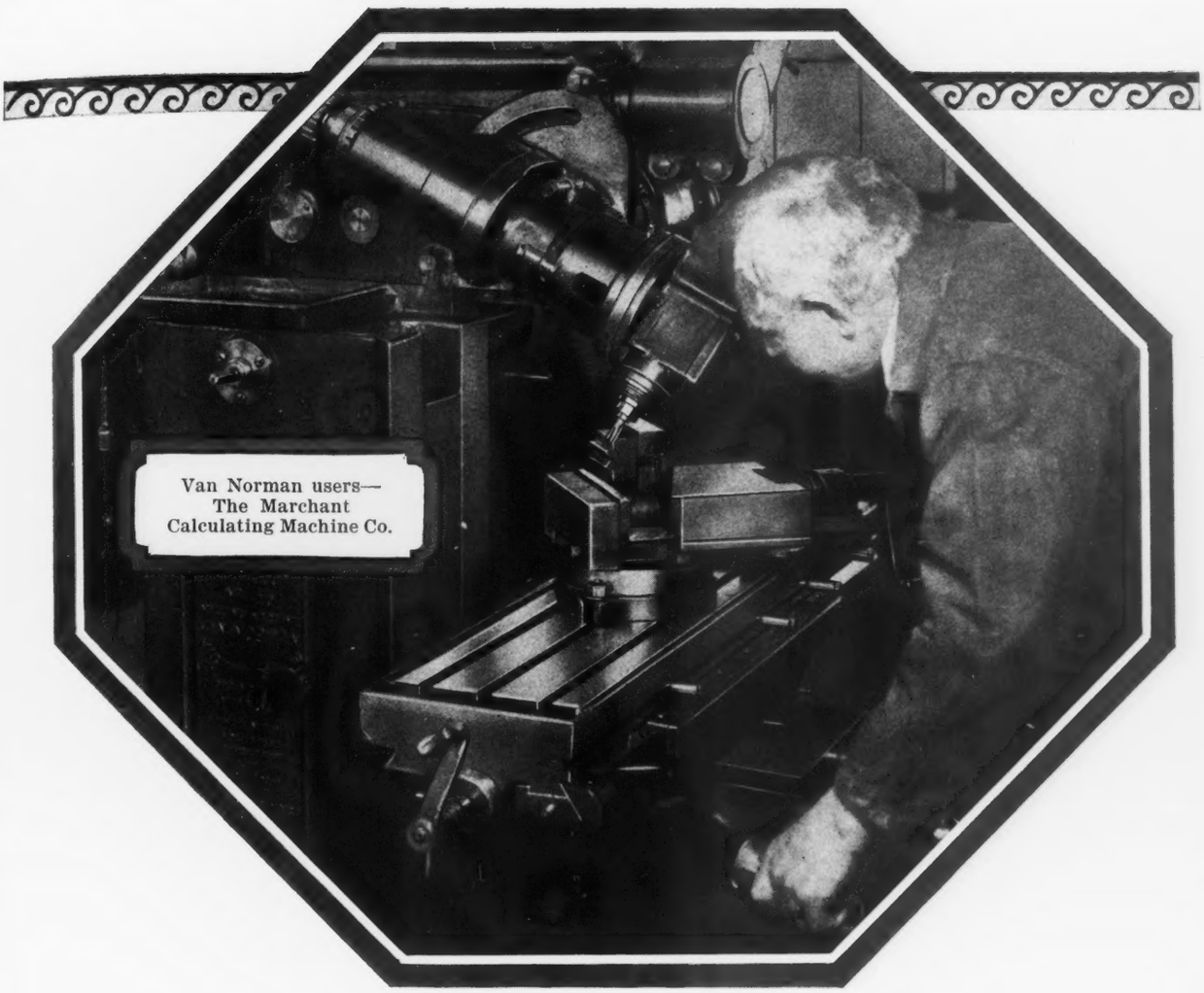
A Remarkable Saving—

The Teer-Wickwire Automatic Burr Cutter removes the cut-off burr on cap screws at a labor cost of less than 2 cents per thousand! A remarkable saving on a necessary operation—the average cost of snagging on this work is 20 to 35 cents per thousand.

And—this Teer-Wickwire production machine makes equally interesting cost reductions on other work that will interest every manufacturer of screw machine products.

Send for details

TEER, WICKWIRE & COMPANY, Jackson, Michigan, U. S. A.



They couldn't have stated the case in fewer words—

THIS is what the Marchant Calculating Machine Company told our photographer: *"The universal features of the Van Norman DUPLEX Miller and the flexibility of the sub-head save much time and money, especially on jig and fixture work."*

Note how the operator is using the sub-head to mill a compound angle. This is a good illustration of how the DUPLEX enables the operator to reach into all of the out-of-way places in box jigs and fixtures. The slotting attachment is invaluable in shaping dies, while the high speed milling attachment with its own motor drive can't be beat for die sinking and similar operations.

The human arm is capable of movement in every direction — so is the Van Norman DUPLEX. This flexibility is a definite asset possessed by no other similar equipment. And it is just this feature that makes it so valuable in the toolroom and pattern shop. It permits one man to perform practically any milling operation at one setting of the work without recourse to other types of millers.

Ask us to go over the DUPLEX with you.

VAN NORMAN MACHINE TOOL COMPANY
150-190 Wilbraham Ave., Springfield, Mass., U.S.A.

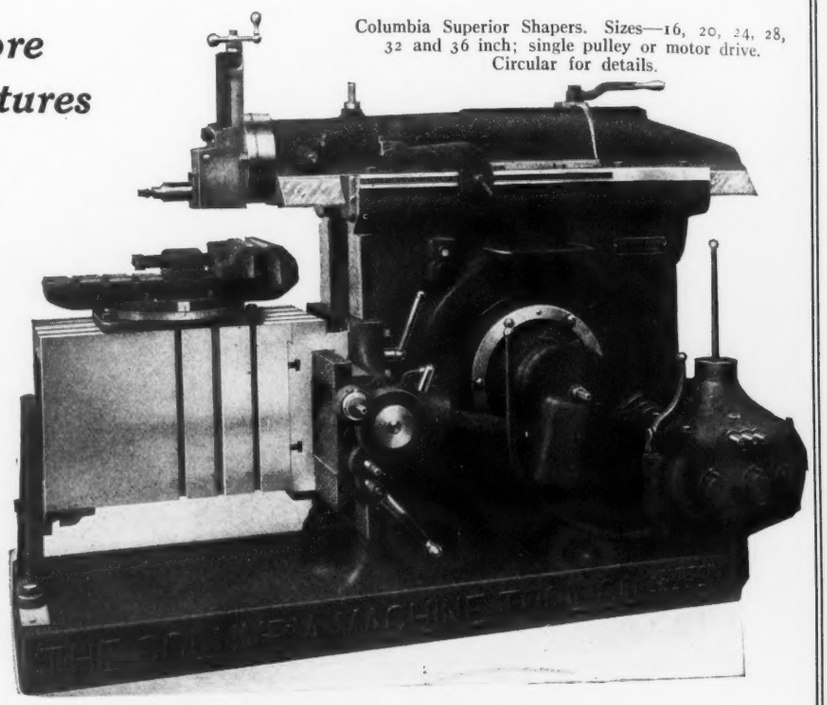
Van Norman
"DUPLEX" Millers

COLUMBIA SUPERIOR SHAPERS

More Than a Score of Profitable Features

These important, economical features, among many others, are found in Columbia Superior Shapers: Flood lubrication; Hardened alloy steel drive gears; Helical bull gear and pinion; "V" ways to ram; selective speed box, one lever control; Quick-change Feed; Full size table —full length of stroke; Gib-bed sliding bearings.

Each feature is designed to provide greatest convenience and economy of operation, and a range in keeping with the strength and durability of the machine. Full details on request.



Columbia Superior Shapers. Sizes—16, 20, 24, 28, 32 and 36 inch; single pulley or motor drive. Circular for details.

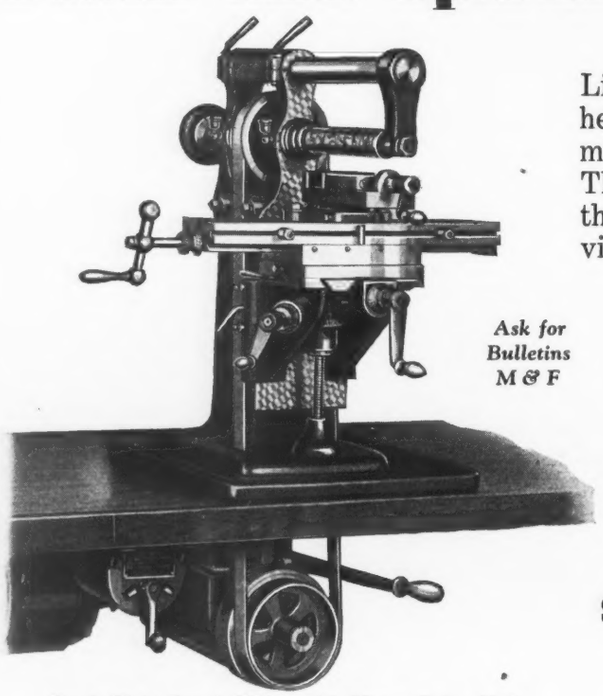
THE COLUMBIA MACHINE TOOL CO.

Hamilton, Ohio, U. S. A.

"Stark"

Plain and Spiral Bench Millers

MOTOR DRIVEN



Ask for Bulletins M & F

Stark Plain Bench Miller with Motor Drive Unit

Lighter, faster and more accurate than heavier millers, they are built for the most exacting tool and experimental work. The compact Motor Drive Unit drives them without overhead shafts, belts or vibration.

Specifications

Travel: longitudinal 10"; transverse 3½"; vertical with vise 4¾".

Table: 18" x 4".

Spindle: hardened and ground with Stark two-angle hardened and ground bearings.

Speeds: 6 135-1050 R.P.M. forward and reverse.

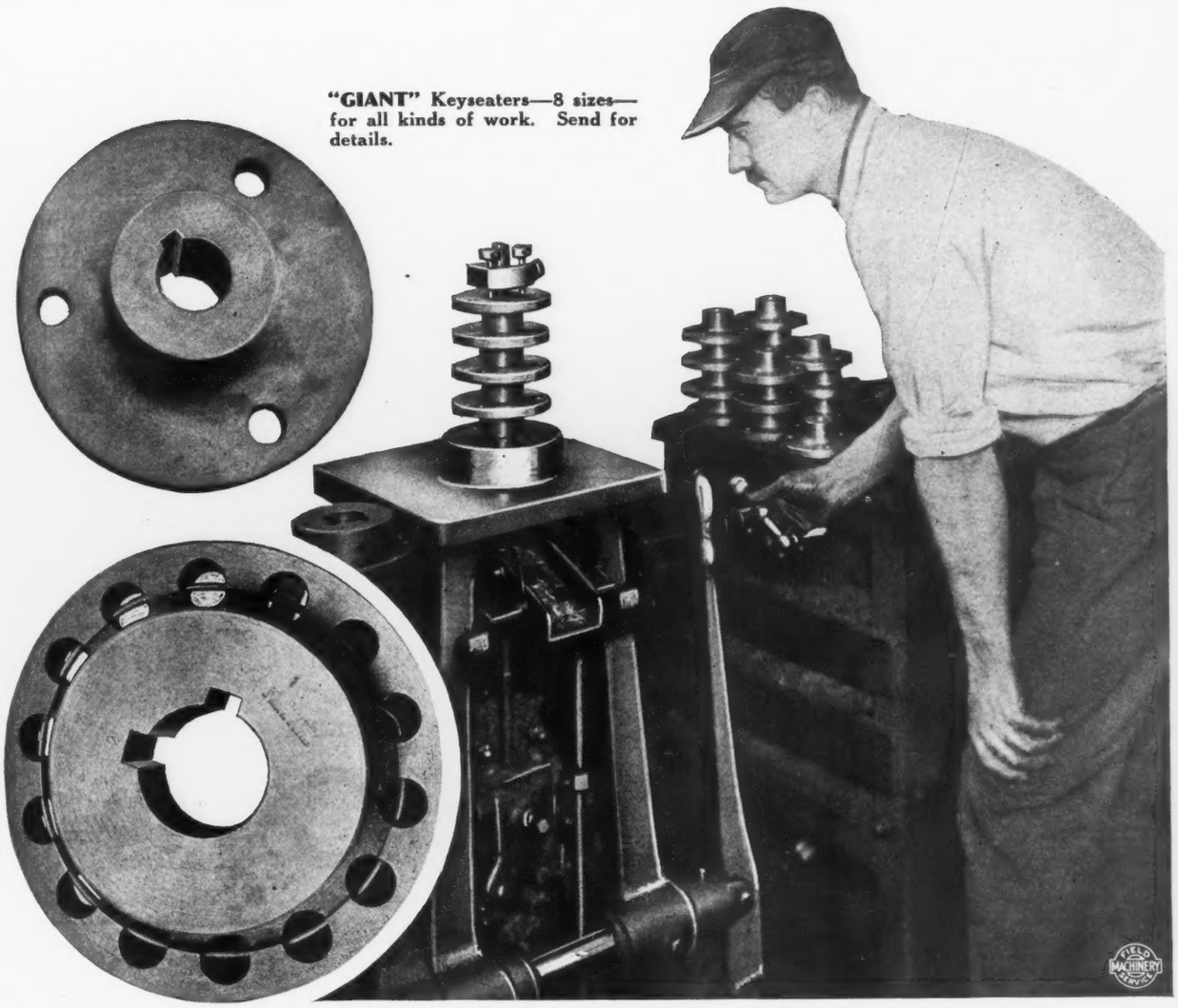
Weight: complete, 340 lbs.

STARK TOOL COMPANY

ESTABLISHED 1862

WALTHAM, MASS.

Originators of the American Bench Lathe



"GIANT" Keyseaters—8 sizes—for all kinds of work. Send for details.

Cutting Four-in-One Speeds Production

The **GIANT** Keyseater is a busy part of the production equipment in the well known pump plant where this photograph was taken.

Cast iron and steel gears and couplings are used in quantity in pump construction—this **GIANT** keyseats them all, easily, economically, efficiently.

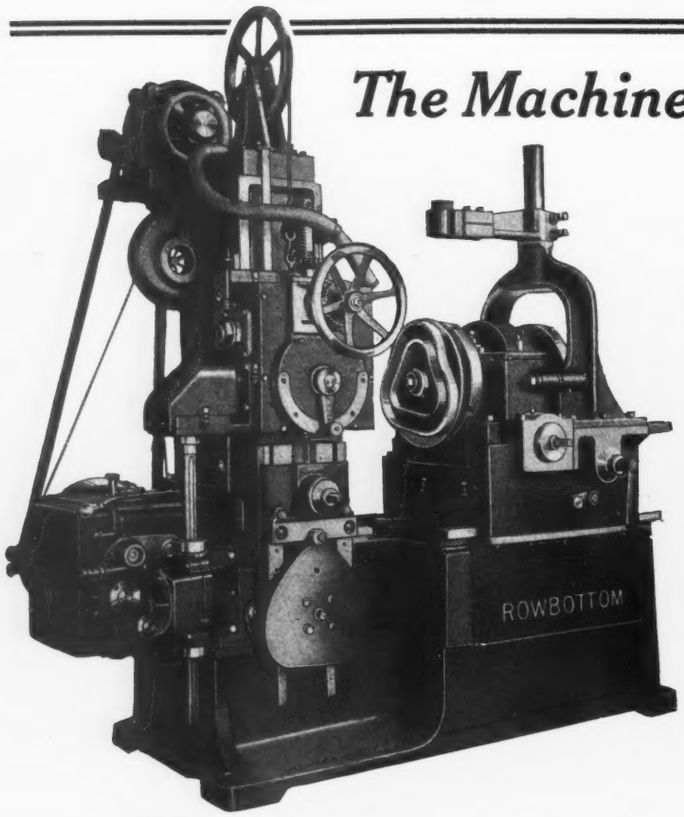
The parts shown on the machine are sump pump couplings — keyseated four at a time (keyways ¼″ by ⅛″ by 1¾″ long) in 2 minutes. The other part is a steel coupling in which two keyways—½″ by ¼″ by 4 in. long—are cut in 10 minutes.

MITTS & MERRILL, 843 Water St., Saginaw, Mich.

California: Herberts-Moore Mchy. Co., San Francisco.

FOREIGN AGENTS: Burton Griffiths & Co., London, England. Aux Forges de Vulcain, Lyons and Paris, France. V. Lowener, Oslo, Norway and Stockholm, Sweden.

"GIANT" Keyseating



The Machine That Has Simplified Cam Production

The Rowbottom Cam Milling Machine—with capacity for Box Cams to 32″ diameter, Face Cams to 28″ diameter, Barrel Cams to 24″ diameter with 11″ throw, ready, with the aid of special attachments, to take care of work to practically any size—insures efficient, accurate, *economical* cam production.

A Rowbottom installation automatically removes one of the chief difficulties in the profitable manufacture of automatics by cutting costs on correctly cut cams.

Send for details of this machine and the *Rowbottom Cam Cutting Contract Service*—send blue prints of your cam needs for estimate.

THE ROWBOTTOM MACHINE CO.
Factory: Waterville, Conn.
WATERBURY, CONN., U. S. A.

Rowbottom for Cams

In Two Minutes—

Machine and work are set up—ready to go. This speed-convenience feature helps reduce production time on Davis Keyseaters by eliminating time wasted between operations.

Capacity for cutting keyseats to 1″ wide in hubs to 12″ high; quality H.S. and Carbon Steel Cutters in sizes from 1/16″ to 1″ in sixteenths and some thirty-seconds, efficiently cover the range of most keyseating operations.

Send for Details of **Davis Keyseaters**

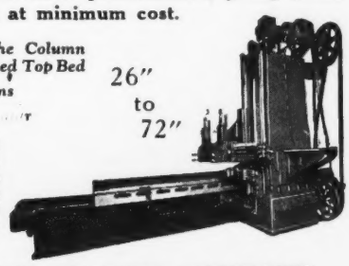
DAVIS KEYSEATER CO.
255 Mill Street, Rochester, N. Y.

Cleveland Open Side Planers

For many years CLEVELAND OPEN SIDE PLANERS have been distinguished for consistent performance, giving quality and quantity production at minimum cost.

The Open Side Planer with the Column Base Cast Integral with its Closed Top Bed
Over 1100 installations
Send for descriptive ci[illegible]r

26″ to 72″



Dial Feed; Power Rapid Traverse; Single Turn Rail Clamp; Automatic Trip to Rail Raising Mechanism; Forced Feed Lubrication to Vees; Improved Head Clamp; Box Table.

THE CLEVELAND PLANER COMPANY
3148 Superior Ave. Established 1900 **CLEVELAND, OHIO**

Universal (Horizontal) Boring Machines

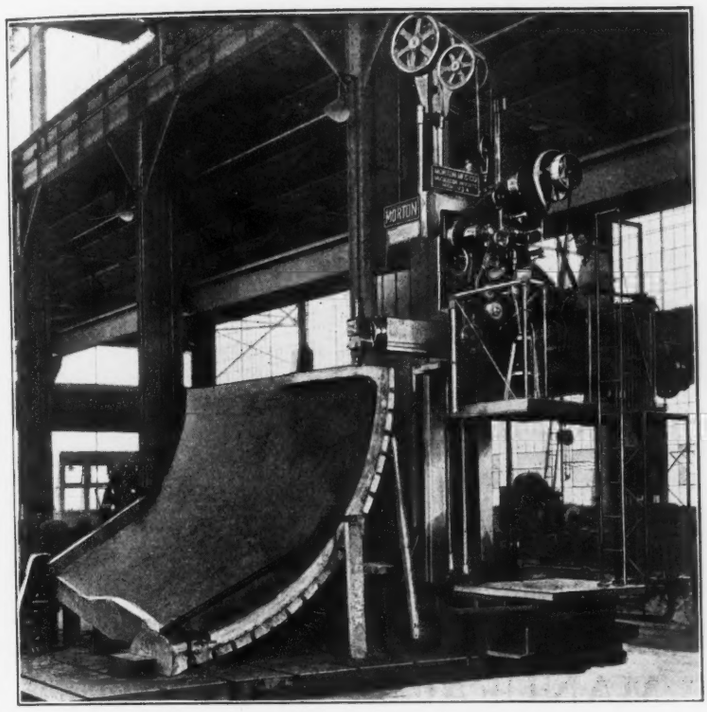
Watch for Our Advertisement
in the October Number of Machinery
"Where Accuracy Counts, We Win"
UNIVERSAL BORING MACHINE COMPANY
HUDSON, MASSACHUSETTS, U. S. A.

Shapers Exclusively

12″, 14″, 16″, 20″, 25″—Gear Box single pulley or motor drive, also, 16″, 20″, 25″, B.G. cone drive with belt shifter. 32″ B.G. all geared single pulley or motor drive, all crank type "V" ram.

THE SMITH & MILLS COMPANY
CINCINNATI OHIO, U. S. A.

Morton Traveling Head Planers Simplify Your Difficult Problems



The Hubbard Steel Foundry Co., East Chicago, Ind., place their difficult machining problems before their 72″ stroke Morton and then forget the job. They are equipped to handle all hard jobs as long as they have a Morton to do the work.

This Traveling Head Planer uses only 15 H.P. and very little floor space. Compare these items to a group of large single purpose tools which are necessary to do the same operations. Bulletin 8D will show some interesting operations solved easily the Morton way.

Robinson Automatic Air Couplings

Eliminate your air worries and losses with this coupling. Special leather gaskets are used which will outwear many months the common rubber gaskets used in other couplings. A sample coupling for inspection and trial is yours upon request. Bulletin 13D.

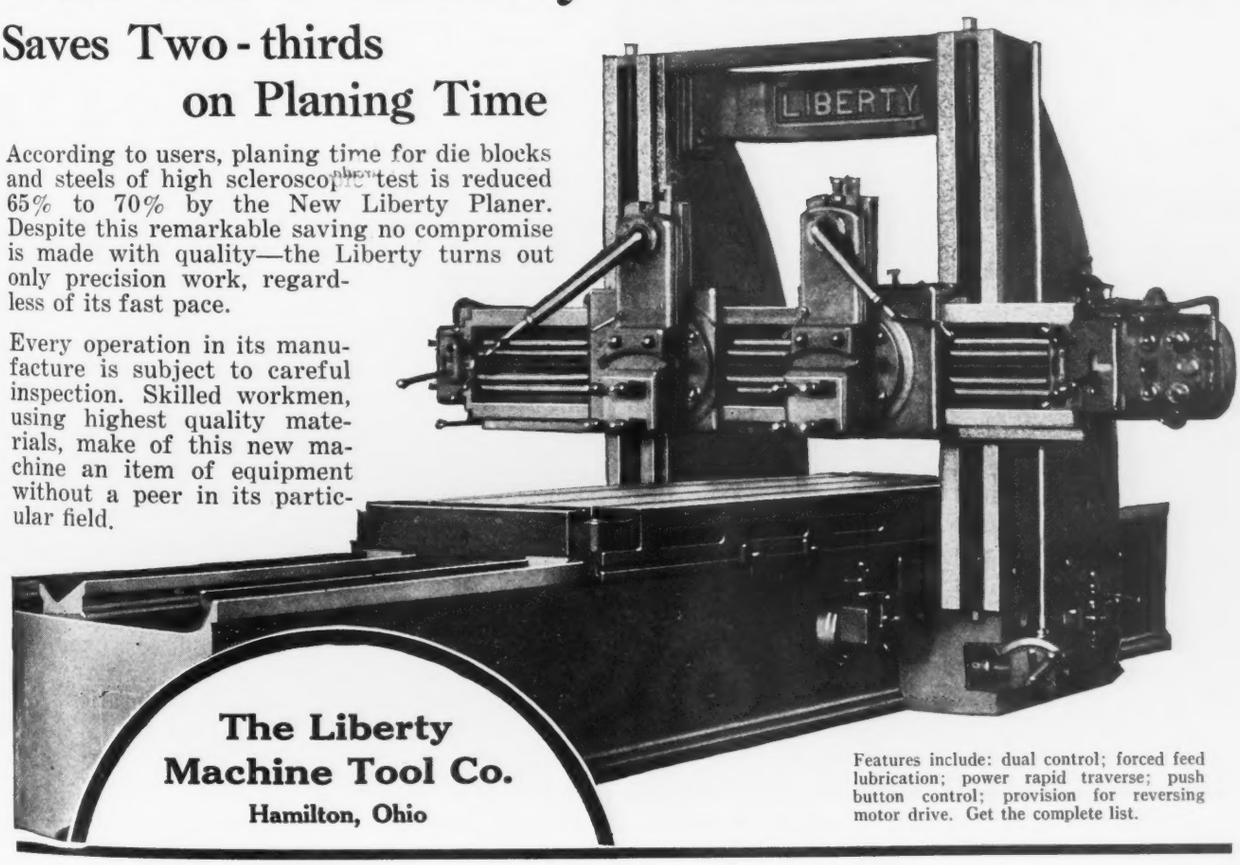
MORTON MANUFACTURING COMPANY, Muskegon Heights, Michigan

The New Liberty Die Block Planer

Saves Two-thirds on Planing Time

According to users, planing time for die blocks and steels of high scleroscope test is reduced 65% to 70% by the New Liberty Planer. Despite this remarkable saving no compromise is made with quality—the Liberty turns out only precision work, regardless of its fast pace.

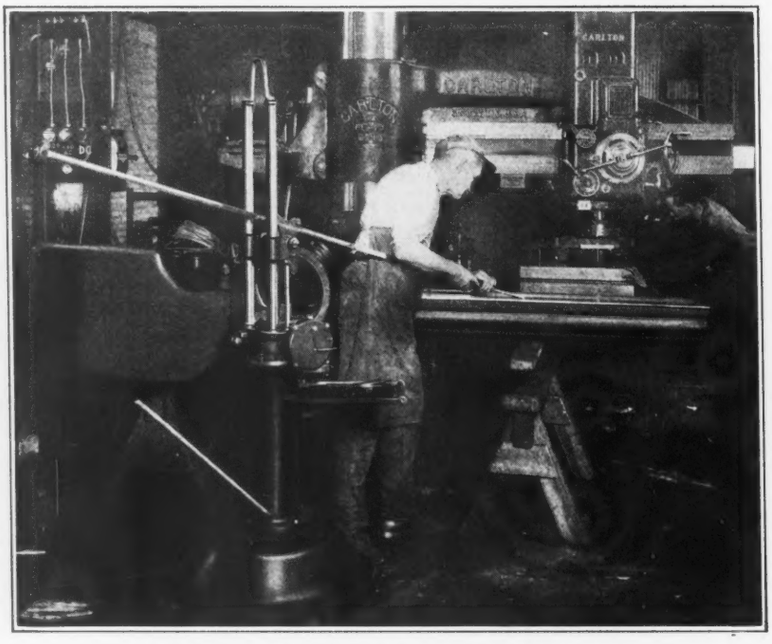
Every operation in its manufacture is subject to careful inspection. Skilled workmen, using highest quality materials, make of this new machine an item of equipment without a peer in its particular field.



The Liberty Machine Tool Co.
Hamilton, Ohio

Features include: dual control; forced feed lubrication; power rapid traverse; push button control; provision for reversing motor drive. Get the complete list.

Do scraping the production way!



An Anderson installation at the Carlton Machine Tool Co.

The ANDERSON POWER SCRAPER

mounted on an elevating truck, is wheeled to the work; the operator locks it rigid, switches on the current and is all set to do better, smoother and more accurate scraping than with a hand tool *and to do it in a fraction of the time.*

Better control with less effort enables him to regulate pressure and get exactly the result desired on every class of work.

Send for details of Anderson Power Scrapers

ANDERSON BROS. MANUFACTURING CO.

1910 Kishwaukee Street, Rockford, Ill.

GREENLEE

Multiple Spindle DRILLING *and* TAPPING MACHINES

FLAT TURRET LATHES

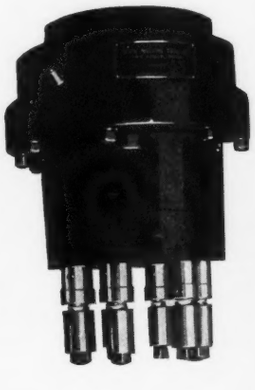
Double End Shaft TURNING LATHES

Special Metal Working MACHINES

GREENLEE BROS. & CO.

ROCKFORD, ILL.

Drilling and Tapping Equipment for High Speed Production



Buhr PATENT

Multiple drilling and tapping heads have been giving satisfaction for over 13 years.

The quality and accuracy remain although prices are lower.

Good engineering always goes with Buhr products.

Don't let anyone say it can't be done.

Write us about your adjustable or fixed center problem—We have the solution. Any drilling problem will receive consideration.

The Buhr Machine Tool Co.

839 Greene Street **ANN ARBOR, MICH.**

GRANT Rotary Vibratory Riveter

Installed by the Lambert Meter Co., Brooklyn, "to increase production and obtain better finish on gas meter parts" — Grant Riveting has become an integral part of their production schedule.

Accuracy is requisite in gas meter construction. Without it there would be registry faults—and trouble. Parts like this flag arm, for controlling gas flow through the meter, are important. The three pieces are assembled in an accurate rolling fit (not too loose or too tight) at the rate of 300 per hour. Typical Grant Riveting production on a typically exacting piece of work.

The Grant Mfg. & Machine Co.

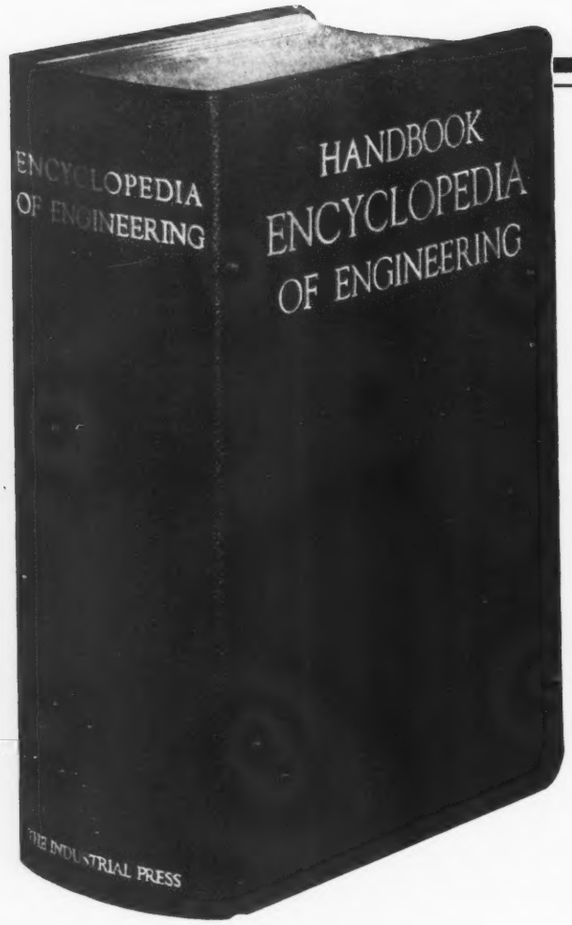
N. W. Station, BRIDGEPORT, CONN.

GRANT Noiseless Rivet Spinner

Ability to stand up to the job is the chief requirement of Grant Rivets used to assemble motor cycle parts.

Sturdy rivets — well set, smooth, well finished—are important factors in securing the enduring "rattle proof" construction that has helped make the reputation of the machines manufactured in the plant where this Grant Noiseless Rivet Spinner installation was photographed.

What do *you* rivet? Is your specific requirement accuracy, strength, finish or costs? Whatever your problem, the correct Grant Riveter, designated by Grant Engineers, will probably solve it for you.



THIS new Handbook-Encyclopedia gives the outstanding facts about 4150 subjects, including such useful matter as the composition and strength of all kinds of standard and special metals used in machine construction; all of the important mechanical laws, rules and principles; brief, simple descriptions of various classes of manufacturing equipment and processes; applications of a wide range of metal-working machines, special tools and instruments; definitions of technical words, shop and trade terms; and MOST IMPORTANT OF ALL—established results and data of great practical value to all designers and builders of mechanical and electrical apparatus.

The Handbook-Encyclopedia is flexibly bound in dark blue Atholeather. Page is 4½″ x 7″ — clear readable type. Thumb indexed for quick reference, and all subjects arranged alphabetically under headings naturally looked for.

Handbook-Encyclopedia of Engineering

COUPON

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A Book for every man who can use the essential facts about thousands of standard and special subjects allied to engineering, mechanics, mechanical equipment and materials, shop and factory operation.

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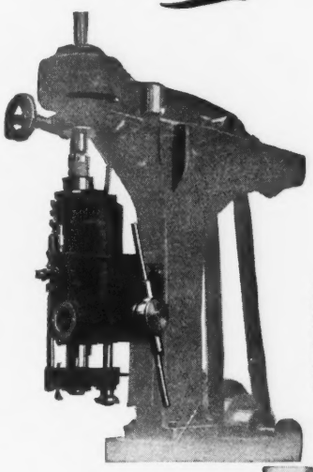
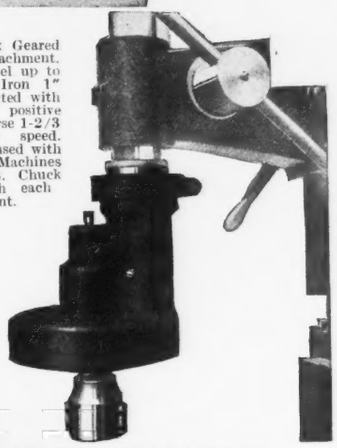
Avey Production Tapping

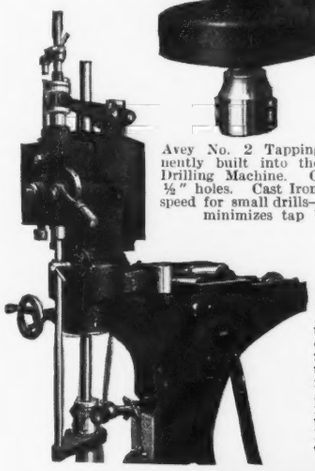
Large Holes — Small Holes in Steel, Cast Iron and Softer Metals



Avey No. 3 Tapping and Drilling Head. Built into the sliding head of the No. 3 Avey Drilling Machine. For heavy drilling and tapping:—Steel 1", Cast Iron 1 ½" holes. Drilling speeds are obtained with all gears disengaged.

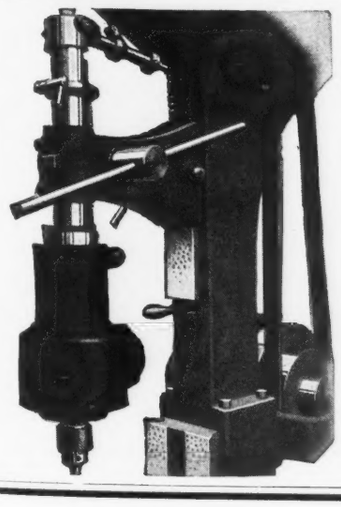


The Avey Back Geared Tapping Attachment. Capacity in Steel up to ½", in Cast Iron 1" holes. Constructed with ball bearings, positive clutch, and reverse 1-2/3 times tapping speed. Adapted to be used with Avey Drilling Machines Nos. 1, 2 and 3. Chuck furnished with each Attachment.



Avey No. 2 Tapping Unit permanently built into the No. 2 Avey Drilling Machine. Capacity—Steel ½" holes. Cast Iron—1". Ample speed for small drills—special clutch minimizes tap breakage.

Avey Friction Tapping Attachments for light tapping up to ½" in cast iron. Cup and cone friction clutch reduces tap breakage. Ball bearing throughout, positive, and requires no change in sleeve or spindle for use with Avey Drilling Machines Nos. ½ to 2. Chuck furnished with each Attachment.



Avey Tapping Attachments provide *correct tapping equipment* to obtain maximum production efficiency on every class of tapping.

There are two styles of Avey Built-in Tapping Attachments for every Avey Drilling Machine; there are five sizes in the Plain Tapping model, three sizes in the Back Geared model. Each has speed, power and accuracy to insure clean, fast tapping, smooth operation and freedom from tap breakage, essential to continuous production of perfect tapped holes.

An Avey Tapping Attachment on an Avey Drilling Machine insures efficient tapping and low production costs.

Send for a catalog of Avey Tapping Attachments.

AVEY PRODUCTS

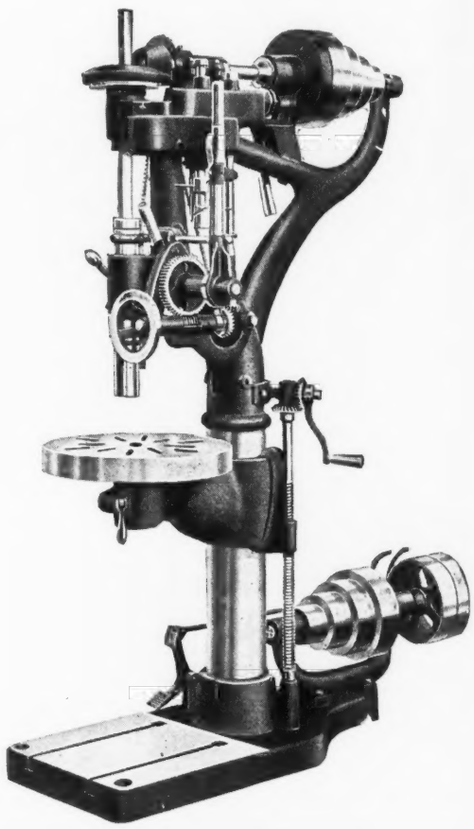
AVEY DRILLING MACHINES—5 sizes
AVEY-MATIC DRILLING MACHINES—3 sizes
AVEY BUILT-IN TAPPING UNITS—2 styles
AVEY TAPPING ATTACHMENTS—plain—5 sizes
AVEY TAPPING ATTACHMENTS—back geared—3 sizes
INDIVIDUAL MOTOR UNITS—2 styles
AVEY MILBAND CUTTING-OFF MACHINES
AVEY PULLEY LATHES
BERJO VISES

The Avey Drilling Machine Co., Inc.
CINCINNATI, OHIO

Mechanics Drills

(ROCKFORD MACHINE TOOL LINE)

A Well-Known Line of Modern Production Machines



Now built at the Barker Machine & Tool Works, by machine tool specialists in a modern plant.

Mechanics Upright Drills are made in 14″, 20″, 23″, 24″, 28″, 32″ and 36″ sizes — each machine from the smallest to the largest designed and built to operate with maximum efficiency on work within its range. All are noted for power, simplicity, durability and accuracy and all Mechanics Upright Drills may be had in gangs or singly.

Send for details of the Mechanics Line

BARKER MACHINE & TOOL WORKS

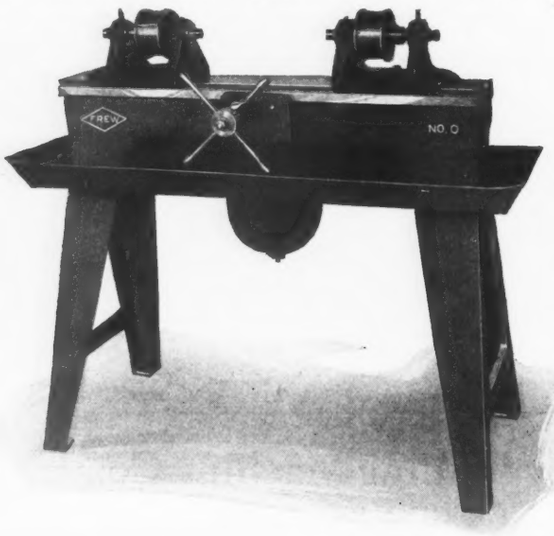
Green Bay, Wisconsin

The FREW No. 0 Duplex Horizontal Drill

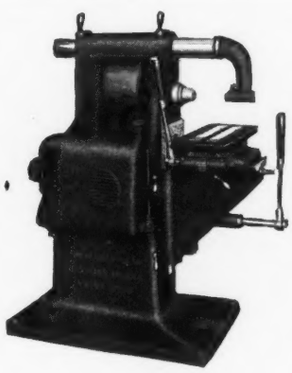
Drill, Counterbore, Hollow Mill, etc., from both ends at once, on work held in a fixture mounted on the bed; insure accuracy, save time and secure uniformity on a run of work.

The Frew No. 0 Duplex Horizontal Drill is strongly built, accurate and carefully aligned—it is a profitable piece of production equipment.

Heads operated by hand screw feed, lever feed to each head, single lever to both heads or power feed if desired.



Send for details of Frew No. 0 Duplex Horizontal Drill—note its production advantages.



FREW

An Efficient Hand Miller

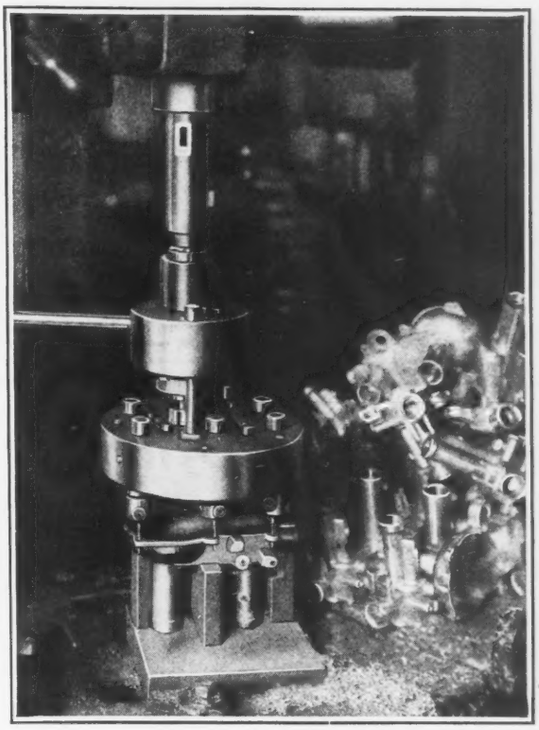
Well built, sturdy, accurate—an efficient machine that saves money on a wide range of work, profitably supplanting the big milling machines on many jobs. Send for details.

The Frew Machine Company

132 W. Venango St., Philadelphia, Pa.

ERRINGTON MULTIPLE TAPPING HEADS

Increased Production from 80 to 600 per hour, Aluminum Carburetor Bodies having six No. 10-32 holes each



Errington Progressive-Production Outfits assure an Interchangeability of Product and a Definite Quantity of Output per hour.

The Light-Weight, Compact and Durable Errington Design has been evolved through almost forty years "Life Study" of this class of Metal Working Tools, for the largest Specialty Manufacturers both in this country and Europe.

Replying to our Service Dept., one client says:—"We have 30 to 40 of your Multiple Heads, some used every day for four years past, yet we cannot find any present need for repairs in any of them. What is the analysis of the bearing-metal you use?"

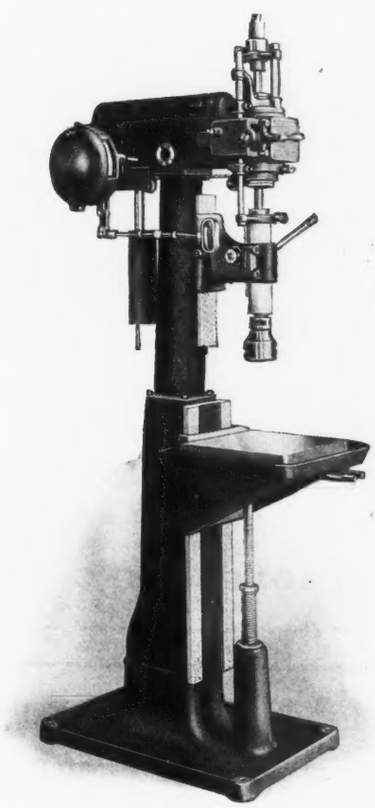
ERRINGTON
MECHANICAL LABORATORY

Main Office and Works: Staten Island, N. Y.

200 Broadway
New York

549 W. Washington Boulevard
Chicago

830 Old South Bldg.
Boston, Mass.



Simmons Tapping Is Fast—and Consistently Accurate

"Amazing," say new users of the Simmons Automatic Tapper No. 4—and it's just that. Wide range of operations, speed enough for the most demanding production schedule, and consistent precision, no matter how fast the output.

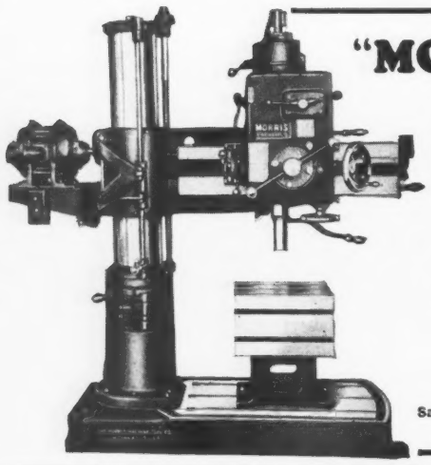
Geared head, and a tap that is fed automatically by the patented lead nut attached to upper end of the spindle; extra size SKF bearings throughout; automatic reverse that can be set to limit the stroke to the proper length; three speeds through sliding gears; high grade alloy steel spindle—these are only a few of an unparalleled number of features that produce big earnings on small or large lot work up to ¾" in steel.

Get in touch with us for complete details of our Tapping and Drilling Machines.

W. H. SIMMONS & CO.

208-10-12 Lawrence Street

CINCINNATI, OHIO



"MOR-SPEED"— Greater Accuracy

In "Mor-Speed" Radials you will find the best features, equipment and workmanship that can be had—reasons why these machines are so fast, economical and lasting. Timken Roller Bearings indicate the quality standard.

"Mor-Speeds" are built in 3′ and 4′ sizes, with a capacity for holes up to 1½" diameter. You'll be interested in the unique operating conveniences. Write for details.

THE MORRIS MACHINE TOOL COMPANY
CINCINNATI, OHIO

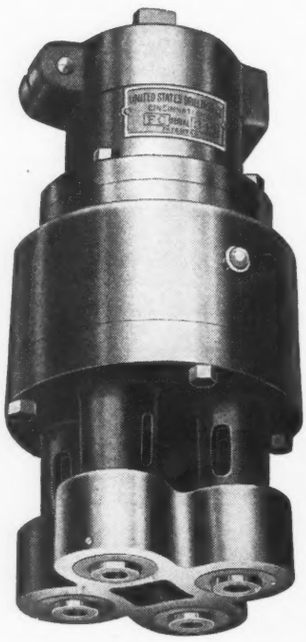
Sold by Pratt and Whitney Company
Agency Sales Department—Hartford, Connecticut

Sales Offices in: Birmingham, Boston, Chicago, San Francisco, Cincinnati, Cleveland, Detroit, Los Angeles, New York, Philadelphia, Pittsburgh, Rochester, St. Louis.

U.S. Multiple Drill Head

With this simple attachment on your one-hole-at-a-time drilling machine you can drill two, six or a dozen holes in the time it takes to drill one, and at a fraction of the cost of a multiple spindle drill press.

Send blueprints or sketches for our estimate of the savings possible on your work.

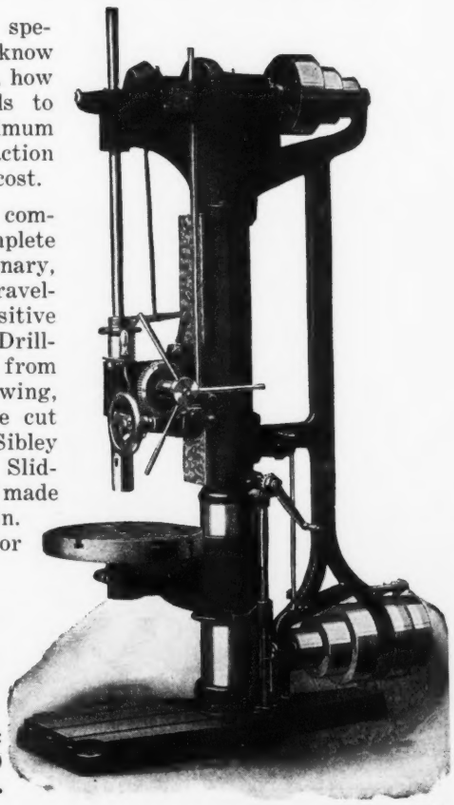


United States Drill Head Co.
1948 W. Sixth Street, CINCINNATI, OHIO
Michigan Agents—National Sales Engrg. Corp., Detroit

What we know about Drills—

We are drill specialists and know how to design, how to build drills to give maximum service satisfaction at minimum cost.

Sibley Drills comprise a complete line of stationary, sliding and traveling head Sensitive and Hi-Speed Drilling Machines from 16 to 30 inch swing, inclusive. The cut shows the Sibley Heavy Duty Sliding Head Drill made in 24, 26, 28 in. sizes. Send for details.



SIBLEY MACHINE COMPANY
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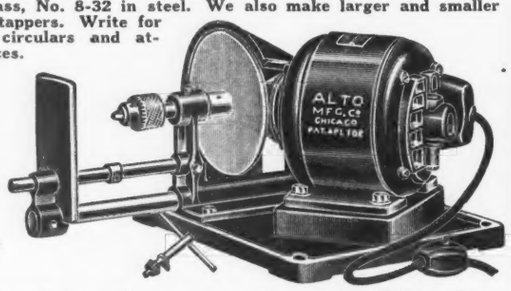
SOUTH BEND IND., U. S. A.

No. 1-A ALTO High Speed Motor Driven Tapping Machine

Principal Features Include: High speed, with double speed reverse; compact, complete, ready to attach to light socket—no belts or countershafts required. Simple positive construction allows low price. Capacity 5/16" in brass, No. 8-32 in steel. We also make larger and smaller high speed tappers. Write for descriptive circulars and attractive prices.

Saves Time—
Saves Taps—
Saves Expense



The Alto Manufacturing Co., 1647-51 Wolfram Street CHICAGO, ILL.

HŒFER Auxiliary Head

Makes your single spindle drilling machine yield multi-spindle profits.

Branches in Principal Cities

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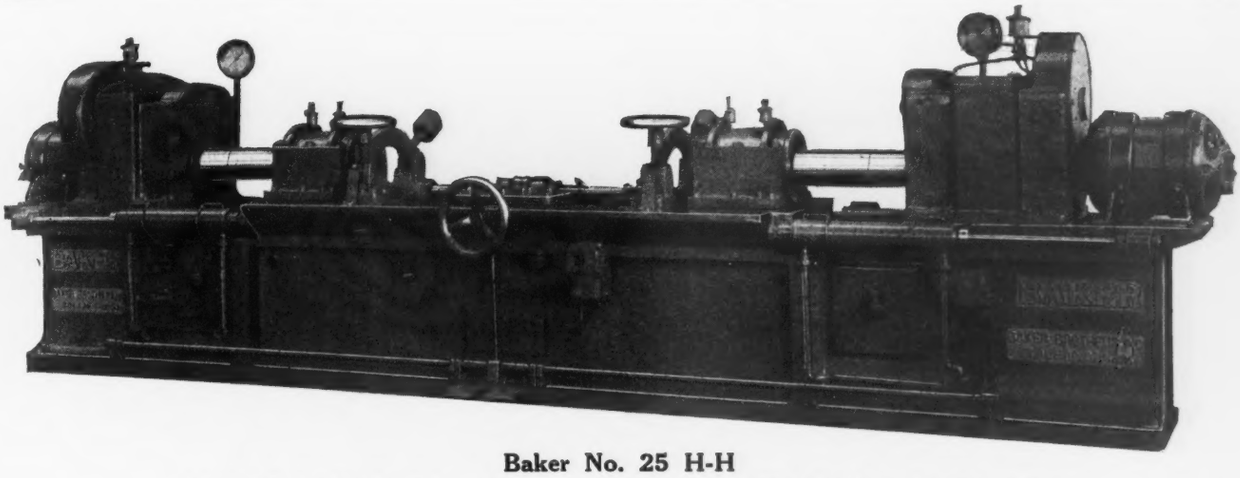
FREEPORT, ILL.

RADIAL DRILLS

The Dreses Machine Tool Co.
Cincinnati, Ohio

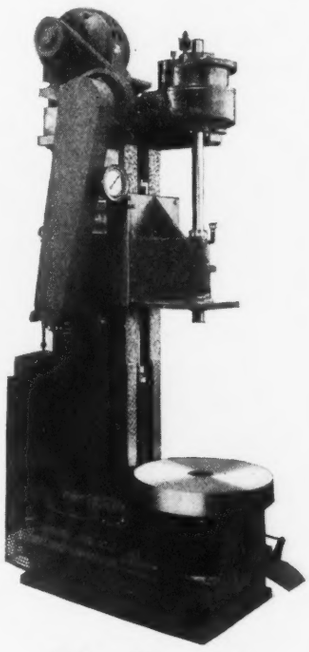


Baker No. 25 H-H

A hydraulic feed horizontal machine made with single or multiple heads, and center section to suit customer's requirements. Separate "Oil Gear" pump for each end.

Hydraulic Equipment by

BAKER



Baker No. 10 H

Fitted with flanged head for attaching multiple head, and indexing table.

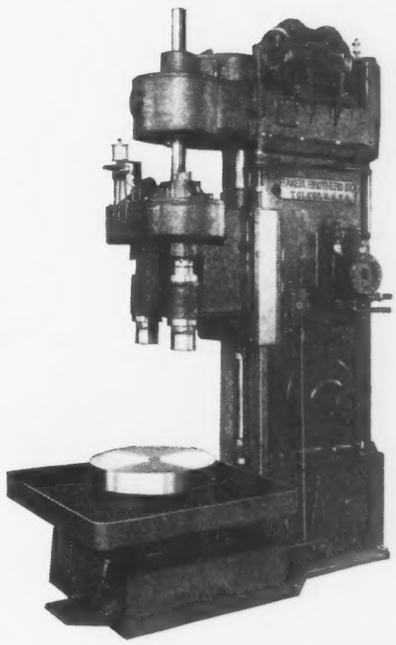
MODERN production methods demand equipment of the highest type to prevent disruption of schedules. Costs also are a major factor — they must be kept at a low level.

The Baker Line is most complete. It comprises Keyseaters and Heavy-Duty Geared Feed Drilling and Boring Machines.

It also includes hydraulic equipment for heavy-duty service.

The hydraulic units are built in a wide range of types and sizes —single or multiple spindle, vertical or horizontal.

Send for detailed lists.



Baker No. 25 H

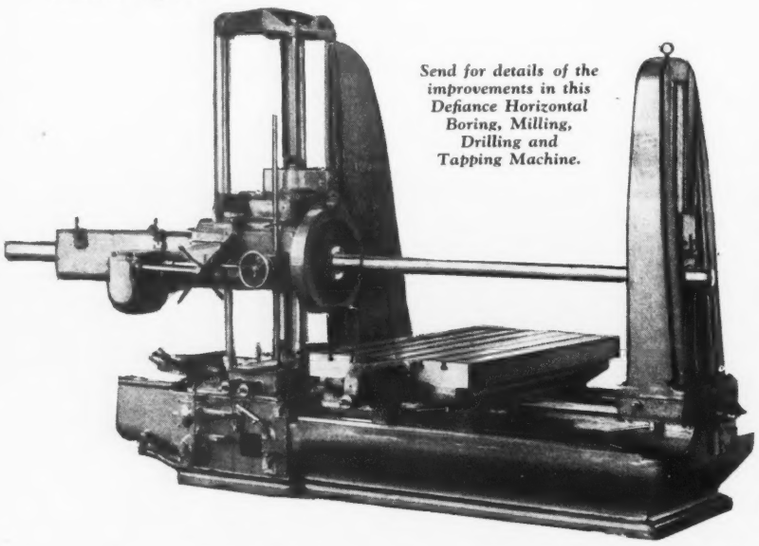
Fitted with 2 spindle head and indexing table.

BAKER BROTHERS, Inc., Toledo, Ohio, U. S. A.

Builders of Boring, Drilling, Tapping, Keyseaters and Slotting Equipment

Designed for Still Greater Production Efficiency

The Defiance Horizontal Boring, Milling, Drilling and Tapping Machine No. 6—fundamentally correct design recently improved to keep a step ahead in an important field. Among other features are independent rapid traverse to head and platen in all directions, with motions at the rate of 84″ per minute; completely enclosed head and feed and speed boxes with forced feed lubrication; ball thrust bearings for the spindles and roller bearings for speed and feed boxes. Ample weight and power and convenient controls—a wide range of speeds and feeds insure efficient production.



Send for details of the improvements in this Defiance Horizontal Boring, Milling, Drilling and Tapping Machine.

The Defiance Line

Horizontal Boring Mills
Cylinder Boring Machines
Heavy Service Drilling Machines
Rail Drills
Multiple Drilling Machines
Multiple Tapping Machines
Valve Grinding Machines

The Defiance Machine Works

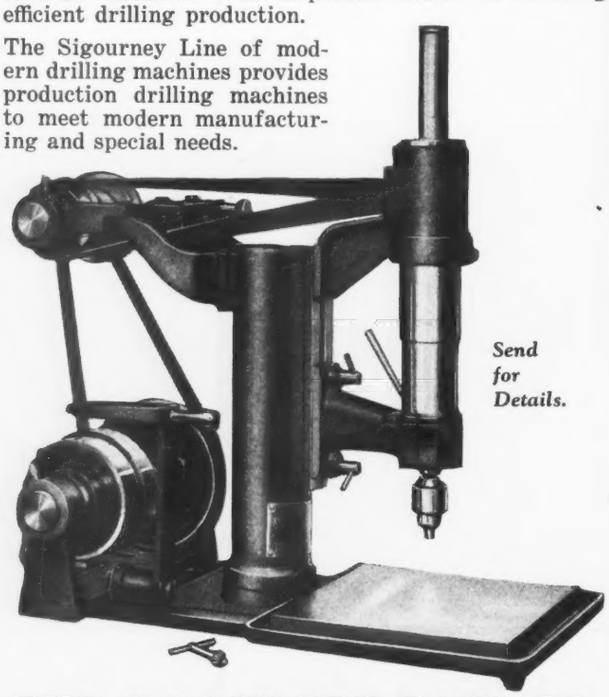
Defiance, Ohio

New York Since 1850 London

SELECTIVE SPEEDS to 10,000 R. P. M.

Sigourney design, in this No. 0 Ball Bearing Sensitive Bench Drill, provides the correct speed for drilling holes to 3/16″ diameter — an important factor in securing efficient drilling production.

The Sigourney Line of modern drilling machines provides production drilling machines to meet modern manufacturing and special needs.

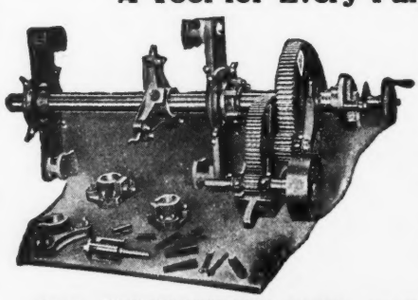


Send for Details.

THE SIGOURNEY TOOL CO.
11 Sigourney St., Hartford, Conn., U. S. A.

Underwood Portable Tools

A Tool for Every Purpose



Portable Boring Bars
Crank Pin Turning Machines
Pipe Benders
Rotary Planers
Milling Machines
Flue Cleaners
Special Machines

H. B. UNDERWOOD CORP., Philadelphia, Pa.
Established 1870

Do You Require **GREAT PRODUCTION?**

Send us Blueprints or Samples of your
Drilling, Boring, Reaming, Counterboring, Lapping, Tapping or Facing Problems

and let us send you our recommendations on a **"HOLE HOG"**

MOLINE TOOL CO., Moline, Ill.

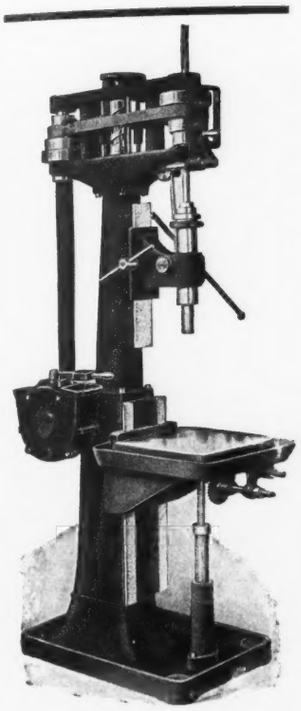
JONES MACHINE TOOLS

PATENTED

Horizontal Boring Mills **Slotters**
Vertical Boring Mills **Vertical Shapers**

JONES MACHINE TOOL WORKS, Inc.
53rd and Lansdowne Avenue, Philadelphia, Pa.

"What make is it?"



How often we hear that question! We hear it applied to automobiles, washing machines, fishing tackle, machine tools—almost every item we buy and use. What make is it? What difference does it make? Just this. Few men, even experts, are competent to judge a finished product, to know the grade of material, the care, the workmanship that has been employed or omitted. The maker's name is the only sound basis of casual judgment.

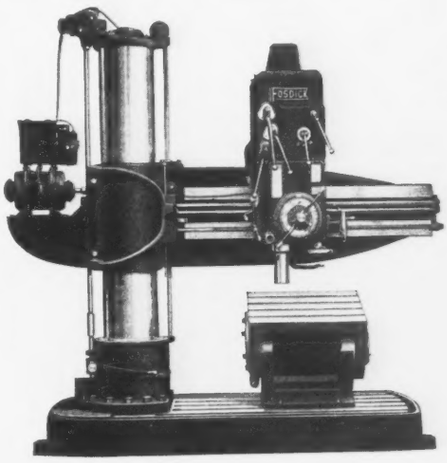
What greater assurance of the *finest* in drilling equipment than the name Fosdick — backed by more than 30 years of specialization in drilling machines. Investigate this line:

RADIALS—Wide range of speeds and feeds — hardened alloy steel gears. 3—8 ft. models. Constant speed motor on arm or base. Also Belt Drive. 3—8 ft. models: capacity 3/16" to 4" drills.

HIGH SPEED SENSITIVES—3, 3½, 4 ft. for drilling and tapping, capacity to 1".

UPRIGHTS—21" to 30". Capacity 3/16" to 3".

BALL BEARING SENSITIVES—13" to 24", 1 to 6 spindles, capacity to 1⅛".



FOSDICK
TRADE MARK REG U S PAT OFF

THE FOSDICK MACHINE TOOL CO., Cincinnati, Ohio, U. S. A.

AGENTS: George Taylor, Boston, Mass. Colcord-Wright Machinery & Supply Co., St. Louis, Mo. Triplex Machine Tool Co., (Radials), Wilson-Brown, Inc., (Sensitives), New York, N. Y. E. A. Kinsey Co., Cincinnati, O., Indianapolis, Ind. Peninsular Machinery Co., Detroit, Mich. Homer, Strong Co., Rochester, N. Y., Buffalo, N. Y. H. A. Smith Machinery Co., Syracuse, N. Y. Swind Machinery Co., Philadelphia, Pa. William K. Stamets (Radials), Arch Machinery Co., (Uprights & Sensitives), Pittsburgh, Pa. Stocker-Rumely-Wachs Co., Chicago, Ill., Milwaukee, Wis. Brownell Mchy. Co., Providence, R. I. The Mine & Smelter Supply Co., Salt Lake City, Utah. C. F. Bulotti Mchy. Co., San Francisco, Cal. Eccles & Davies, Los Angeles, Cal. Bay Verte Machinery Supply Co., Green Bay, Wis. M. A. Wertman Mchy. Co., Cleveland, O. English Bros. Mchy. Co., Kansas City, Mo. Wessendorf Nelms & Co., Houston, Texas. Burton, Griffiths & Co., London, England. Fenwick Freres Co., Paris, France. Wynmalen & Hausman, Rotterdam, Holland, Karlebo, Stockholm, Sweden.

Centralized Control

An Operating Convenience That Spells Economy

Can be furnished in 3, 4, 5, 6, 7 or 8 foot sizes with almost any style table, electric or compressed air column binder, power traverse of head on arm and any style motor drive.

The highly centralized control of Carlton Radials saves users many dollars every year. It provides unsurpassed operating convenience, operator popularity, lower drilling costs.

Because this and every other feature of Carlton Radials has been developed to a high degree of perfection, these machines set the pace for production and "low cost per hole" drilling. Only the finest materials, properly distributed and balanced, are used. If you are interested in *modern* drilling equipment, you'll want to know more about Carlton Radials. Write for complete details.

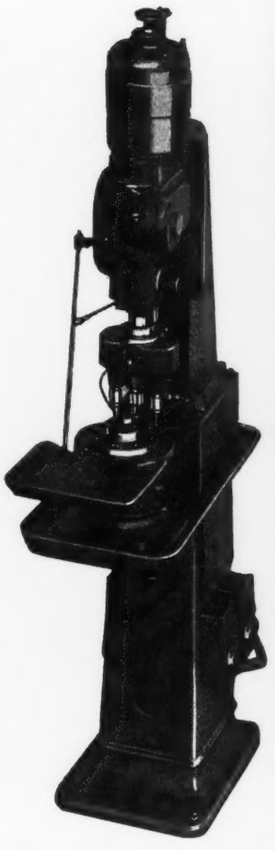
THE CARLTON MACHINE TOOL CO.
CINCINNATI, OHIO, U. S. A.

Production Tapping

of small sheet metal parts can be handled on this KINGSBURY Automatic Dial Feed Tapping Machine. On single hole work this machine will produce up to seventy-five pieces per minute.

This machine can be furnished with one, two or three spindles. The spindles are fixed in position so that there is no chance of their getting out of alignment.

As this is only one of many types of tapping machines which we are prepared to furnish, it may prove worth your while to let us figure on your particular problem.



Kingsbury Machine Tool Corporation

Keene, N. H.

Originators of the Automatic Drilling Head Unit

TO-DAY

See Our Display
Booth 3W18
National Machine Tool Show
CLEVELAND
Sept. 30——Oct. 4

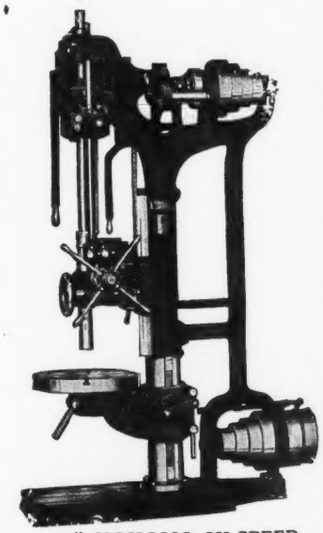
PRODUCTION requirements are such that you cannot afford to risk your production schedule by using old, worn out drilling equipment.

Accordingly, we suggest that when you again contemplate installing new Drilling Equipment that you consider the 25″ KOKOMO HI-SPEED Drilling and Tapping Machine equipped throughout with hi-grade bronze bushed bearings, which fact alone assures you of uninterrupted drilling SERVICE.

Sizes from 10″ to 36″ Inclusive.

We have a complete catalog ready for you. It's yours for the asking.

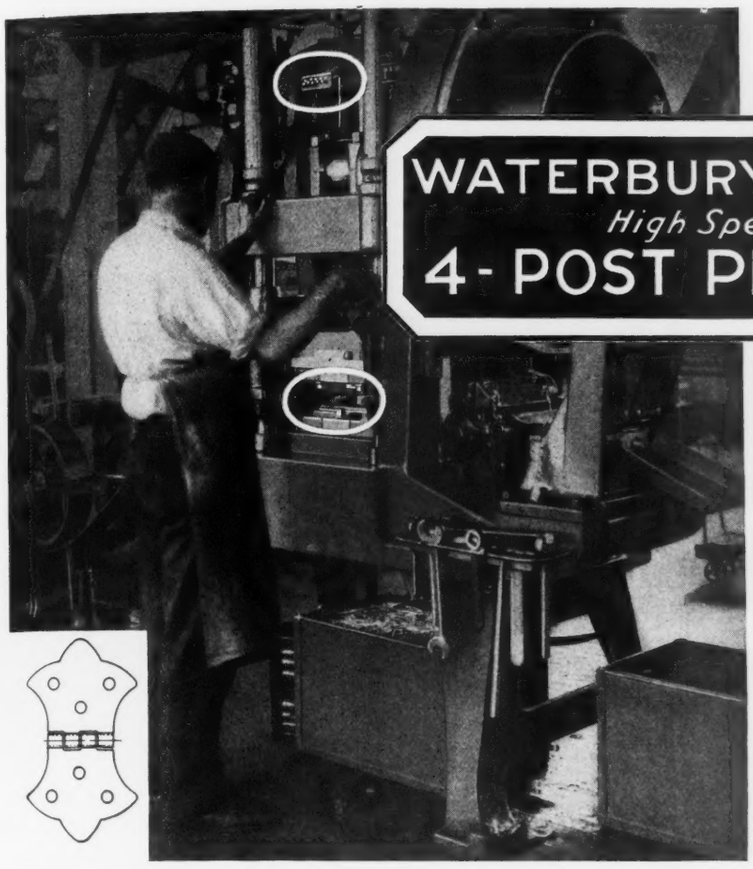
Send the blueprints of your most difficult drilling problems to our engineering department. They'll be pleased to offer their recommendations. No Obligations.



25″ KOKOMO HI-SPEED
Code: Bush-tap

SUPERIOR MACHINE TOOL CO.

P. O. Box 376 **Since 1902** **KOKOMO, INDIANA**



HERE IS ONE AT WORK

in the plant of Veeder-Root, Inc., Bristol, Connecticut, makers of mechanical counters. Millions of "clover leaf" hinges, like that shown, are made by this company in lots of 100,000, that is 200,000 stampings. The stampings are blanked from quarter - hard, cold-rolled steel, 0.045" thick, and pierced. "It is not uncommon," states the Production Manager, "to run three lots of hinges on this 60-ton press without regrinding the tools."

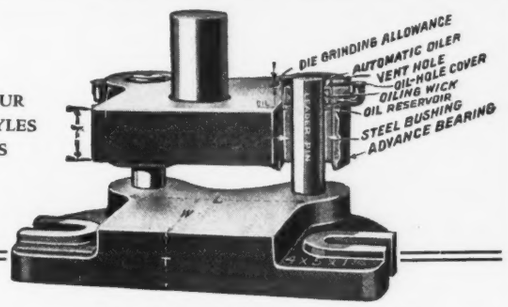
600,000 Stampings without Tool Shear Or Wear!

These presses are made in 20, 40 and 60-ton standard sizes, 300 to 200 R.P.M. The gates are perfectly guided by four posts, a feature which eliminates tool shear. Equipped with a patented high-speed flywheel that runs without vibration, the machines will handle any blanking or follow tool work faster and better than ever handled before.

The Waterbury - Farrel Foundry & Machine Co.

Factory and Home Office: Waterbury, Conn.
Western Office: Cleveland, Ohio.

ONE OF OUR MANY STYLES AND SIZES



Baumbach Standard Automatic Oiled

DIE SETS

Made of 25% Steel

Get our new 120 page Die Set Guide listing 70,000 Sizes. Select your own Standard

Baumbach Die Sets built this Modern Plant

E. A. BAUMBACH MFG. CO.

GENERAL OFFICE & WORKS
1810 South Kilbourn Avenue, CHICAGO, ILLINOIS
Sales and Engineering Offices in principal cities U. S. A. and Canada

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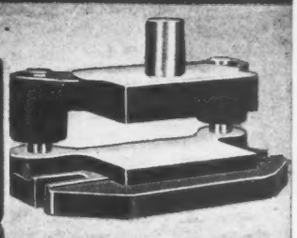
U.S. TOOL

SUB-PRESSES
DIE SETS
DIE MAKERS AND PRESS ROOM SUPPLIES
AUTOMATIC ROLL FEEDS
STOCK REELS



We have one of the largest standard lines of sub-presses and die sets, and it will pay you to standardize on our line.

SEND FOR CATALOGUE (M)

Distributors

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*The Swift Machinery Co., 139 Lafayette St., New York City.
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*Geo. C. MacConnell, 537 N. Grove St., East Orange, N. J.
Leonard R. Nourie, Park Bldg., Pittsburgh, Pa.
*Porter Elec. Mach. Co., 2401 Chestnut St., Philadelphia, Pa.
*A. V. Wiggins, 384 West Fayette St., Syracuse, N. Y.
*The L. A. Benson Co., Inc., 8 E. Lombard St., Baltimore, Md.
*Sub-presses and die sets carried at these points.

U. S. TOOL COMPANY, Inc.
MANUFACTURERS AND ENGINEERS
AMPERE (Newark) N. J.

This is a One Operation Job With Marquette Die Cushions

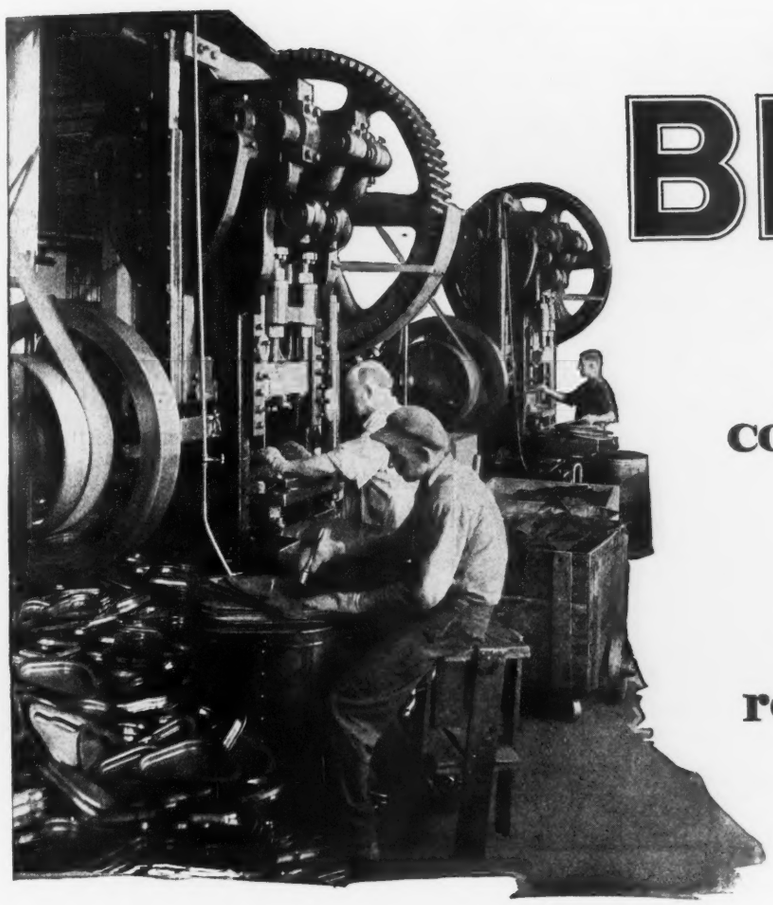
According to the Whiteway Stamping Company, big Cleveland jobbing shop where this stamping is now being made, a certain heater manufacturer brought it to them saying it was impossible to draw the shell satisfactorily on their own presses—which were equipped with springs.

But the Whiteway Company makes a *business* of producing stampings, so all their presses are equipped with Marquette Die Cushions and they were able to handle the job easily.

Today they are drawing this tapered, odd-shaped part from ordinary 22 gauge ternplate on a No. 7 Bliss inclinable press at the rate of 1000 per hour—all strong, smooth shells; no cracks, no wrinkles.

There is a Marquette Cushion for *your* press and *your* job, waiting to pay you a profit. Write us about the job and we will tell you about the cushion.

Marquette
TOOL & MFG. CO.
1904 N. KILBOURN AVE. CHICAGO, ILLINOIS



BLISS

The complete line

A Press for every requirement

YOU can safely depend on the recommendations of Bliss to provide the most efficient type of machine for your particular sheet metal operations.

The wide range of equipment built by Bliss covers every conceivable requirement in sheet metal punching, piercing, blanking, embossing, stamping or forming. Bliss recommendations are therefore not restricted by an incomplete line of equipment.

No matter what material, quantity, size or shape of sheet metal parts you may require, there is a suitable Bliss type that has fully proven its efficiency and dependability in hundreds of installations.

E. W. BLISS CO. MAIN OFFICE AND WORKS **BROOKLYN, N. Y., U. S. A.**

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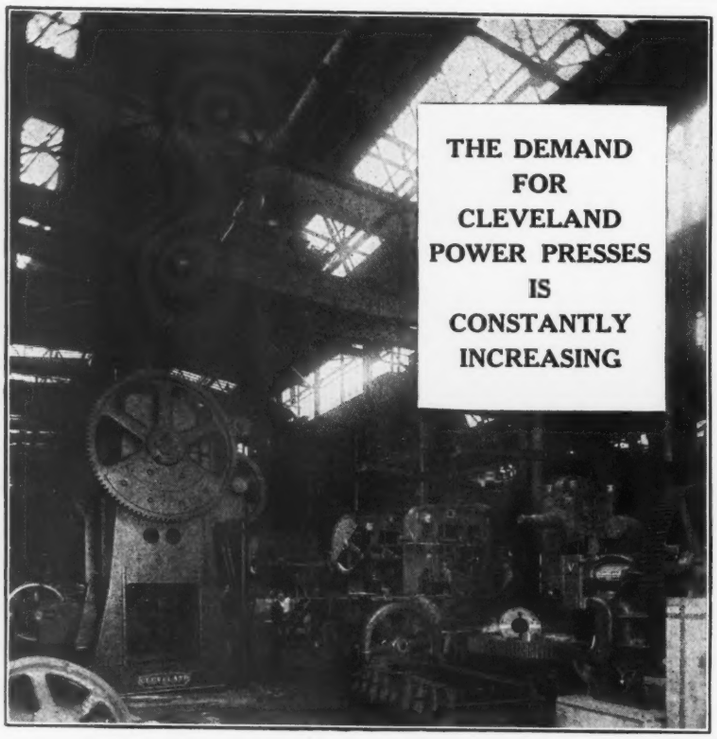

And the Reasons are—

that there is every variation of size, capacity, power application or type; every refinement for quicker, safer operation; every provision for longer "life" and greater strength—consequently there is a Cleveland to do precisely what you want done the way you want to do it.

Get the specifications covering Cleveland Presses.

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THE CLEVELAND PUNCH & SHEAR WORKS CO.
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676 Atkinson Ave.
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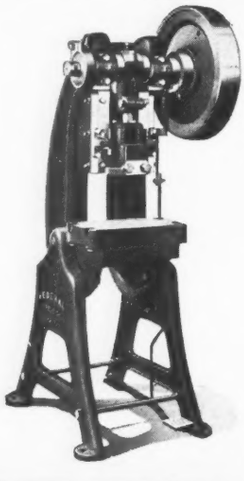

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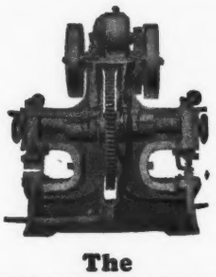
"Built for Service" Presses

Real machine tools, high speed, heavy duty presses, designed and built to meet production demands.

There is a Federal dealer near you who would be glad to be of service to you. We solicit your inquiries.

THE FEDERAL PRESS CO.
ELKHART, IND.



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"Sells" Roller Bearings.
Commercial Roller Bearings.
Power Transmission Machinery.
Excelsior Drills 10", 14", 20".
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(Roller Bearing throughout)

The ROYERSFORD Foundry & Machine Co., Inc.
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Automatic Punch Press Feeds
F. J. LITTELL (Speed With Safety) MACHINE CO.
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Minster Power Presses

Inclinable—Horning—Straight Side—
Knuckle Joint—Gap and Screw Presses
THE MINSTER MACHINE CO.
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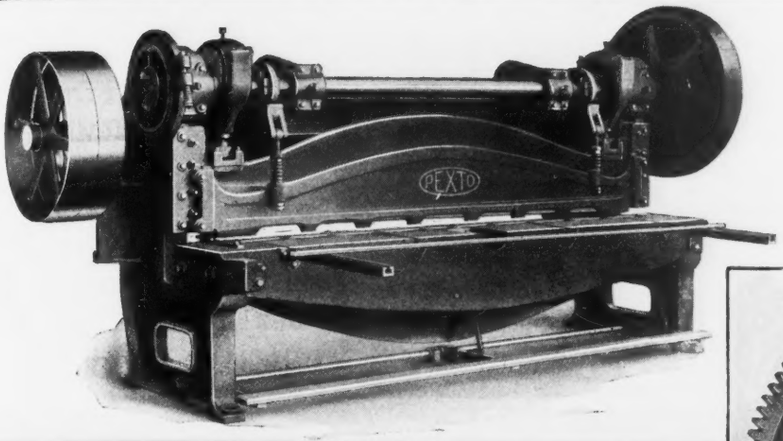
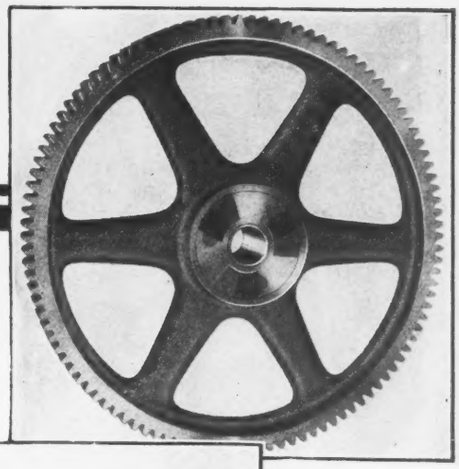
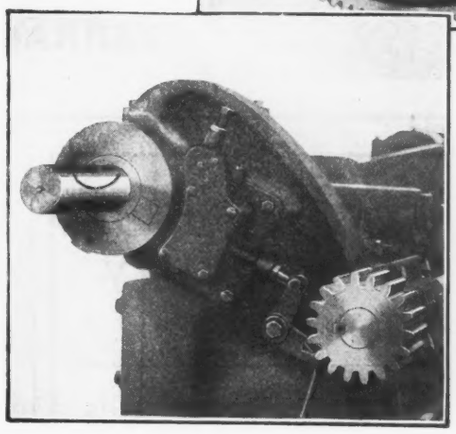
DISTINCTIVE ADVANTAGES





WITH PEXTO POWER SQUARING SHEARS



When you buy a Pexto, you are getting more than an ordinary shears. You are procuring a product that makes for efficiency and economy.

A Power Shears is only as good as the clutch employed. Only Pexto Shears offer this repeating or non-repeating Johnson Safety Square Pin Clutch. The change from repeating to non-repeating can be made in a second. A clutch that can be depended on as reliable and durable.

Pexto Clutch Wheels have three engagement points for speeding up production. Fly wheels and gear wheels are bronzed bushed.

The Pexto trade-mark is backed by an organization that has enjoyed conservative growth for over one hundred years. You will find that Pexto Power Squaring Shears live up to their reputation for standing up under hard usage and ease of performance at the lowest minimum cost for upkeep.

PEXTO

"4 DISTINCTIVE ADVANTAGES"

A folder called "4 Distinctive Advantages" has just been printed. It describes 4 advantages which PEXTO Power Shears offer—4 exclusive improvements which you cannot afford to do without. Send for your copy today.

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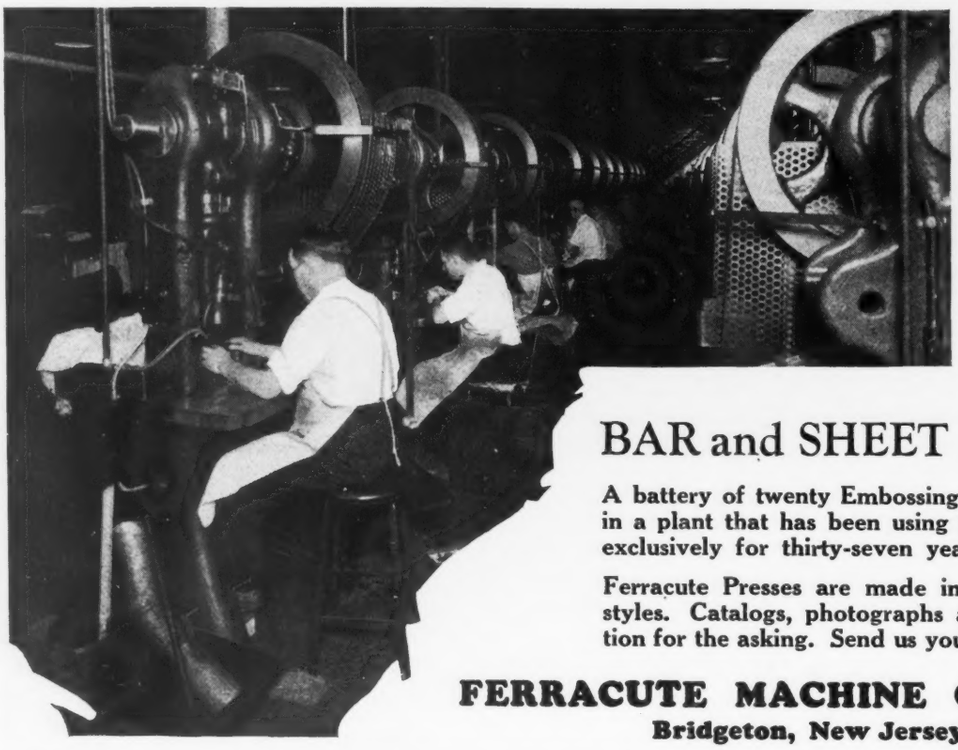
are the result of Sixty-six Years' Experience in designing and building machinery for



CUTTING
FORMING
PUNCHING
SHEARING
STAMPING
EMBOSSING
and
COINING

BAR and SHEET METALS

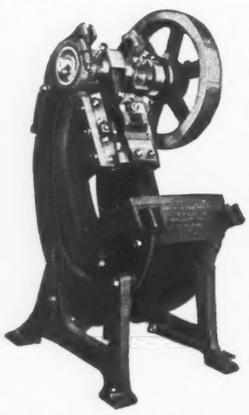
A battery of twenty Embossing Presses is shown in a plant that has been using Ferracute Presses exclusively for thirty-seven years.

Ferracute Presses are made in many sizes and styles. Catalogs, photographs and full information for the asking. Send us your press problems.

FERRACUTE MACHINE COMPANY
Bridgeton, New Jersey

THE "TOLEDO"
PRESSES FOR EVERY PURPOSE!

Open Back Inclinable Presses



Write for details.

Nearly every kind of blank cutting, forming, perforating, shaping and combination die work can be done *more* economically on "Toledo" Open Back Presses.

The "Toledo" line includes two series of this indispensable equipment—Nos. 1 and 70. They are made in 30 sizes weighing from 500 to 60,000 lbs. Available with either straight or inclined legs. Highly dependable for maximum production at a low cost figure.

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Chicago Office: 549 West Washington Blvd.
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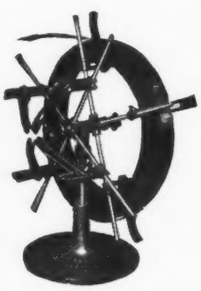
Engineers, Founders and Machinists on Equipment for Sheet Metal Products



Patented

Quick S&S Loading

DOUBLE SWIVEL REELS
for use with roll feeds, etc.

SINGLE INCLINABLE REELS
for hand feeding.

HORIZONTAL REELS
for round wire.

DISC REELS
for brass, copper, etc.

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AUTOMATIC BAIRD MACHINE CO. BRIDGEPORT, CONN. MACHINERY

PRESSES—Foot and Power.
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HYDRAULIC MACHINERY
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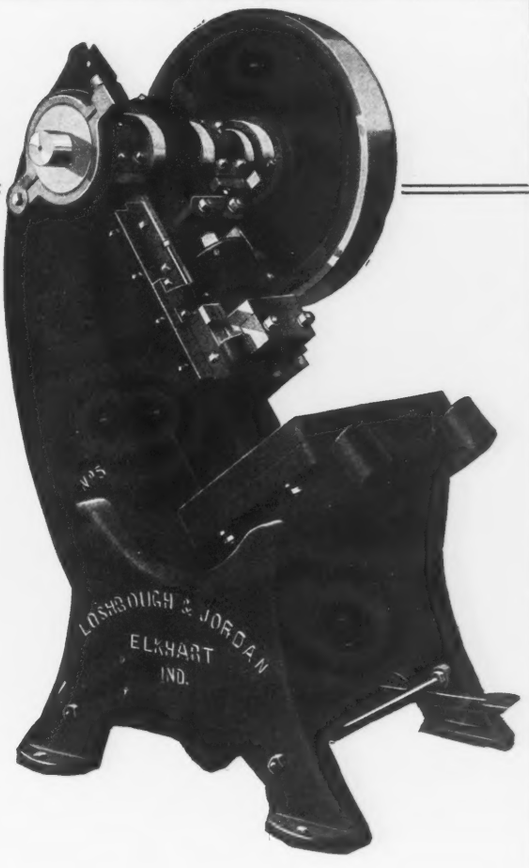
From Motor Cars to Saxophones . . .

LOSHBOUGH-JORDAN *Power Presses*



WHEREVER pressed metal parts are used there's certain to be at least one well-known manufacturer who counts on his Loshbough-Jordan installation to give him press work of a class to insure quality and profits on his product.

There are Loshbough-Jordan Power Presses for all classes of work; there are L-J refinements, and special features in design and construction, that make press work possible *and profitable* on parts and products that might be produced by other methods in less competitive fields.

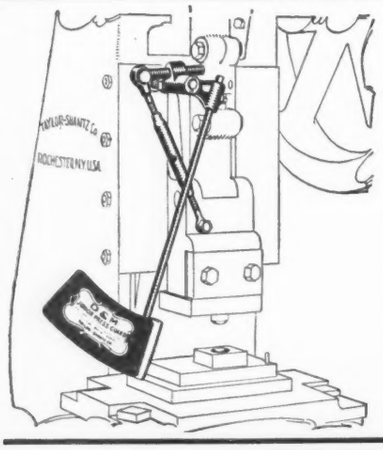
Whatever your product—if it can be stamped—there's an L-J Power Press to make production profitable. Send us details, and ask about the L-J Non-Repeat Tripping Device—the patented safety feature.

The L-J Non-Repeat Tripping Device is supplied for all L-J Presses at low cost.

Loshbough-Jordan Tool & Machine Co.

Exclusive Builders of Inclinable Presses for Seventeen Years

ELKHART, INDIANA



An Accident Insurance Policy

will safeguard you from financial loss—but it *cannot prevent accidents!*

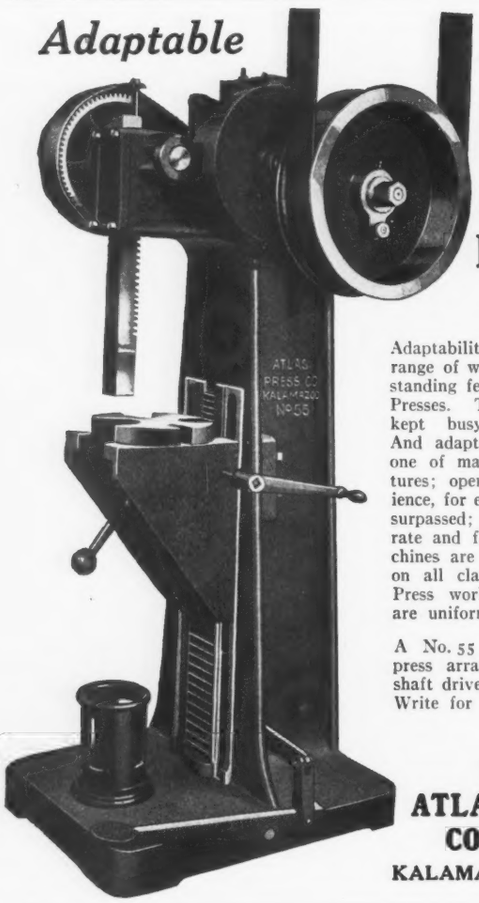
D & M JUNIOR PRESS GUARDS

on your power press make power press accidents impossible. They are simple, easily attached, inexpensive and there is one for every make, size and stroke of press.

Try one for 30 days at our expense. In making inquiries, state name, size and stroke of press and whether left to right or right to left hand swing is preferred. Order D & M Junior Press Guards direct or through your machinery supply house.

TAYLOR-SHANTZ CO., 485 St. Paul Street ROCHESTER, N. Y.

Adaptable



Atlas Power Arbor Presses

Adaptability to a wide range of work is an outstanding feature of Atlas Presses. They can be kept busy, constantly. And adaptability is but one of many Atlas features; operating convenience, for example, is unsurpassed; rugged, accurate and fast, these machines are big producers on all classes of Arbor Press work and results are uniformly good.

A No. 55 Atlas 10-ton press arranged for line shaft drive is illustrated. Write for details.

THE ATLAS PRESS COMPANY
KALAMAZOO, MICH.

PUNCH PRESS GUARDS

The Guard sweeps the entire length of the Bolster Plate on half of the downward stroke of punch. This means that both hands of the operator are protected—*That's Safety*

The Guard returns beyond the center of the Ram, on half of the upward stroke. This allows the operator to feed fast—*That's Speed*

No Adjustments When Changing Dies
OVER 14,000 IN USE
ATTACHED IN ONE HOUR
30 DAYS FREE TRIAL

WIESMAN MFG. COMPANY
31 to 35 South St. Clair St.,
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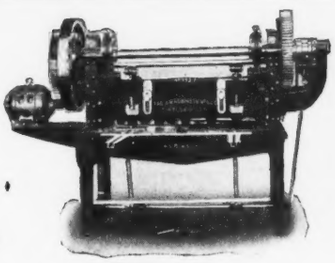
Robinson Sheet Metal Working Machinery



Inclinable Presses
Double Crank Presses
Horning Presses
Toggle Presses
Gap Presses
Squaring Shears
Gap Shears
Corrugating Machines
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NEW ALBANY MACHINE MFG. CO.
Sole Owners J. M. Robinson Mfg. Co.
NEW ALBANY, IND.

There are 8 Types and 16 Sizes

in the* METALWOOD *line of

STRAIGHTENING PRESSES

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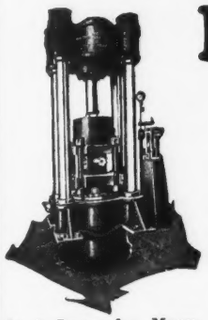
THERE IS NO SUBSTITUTE FOR EXPERIENCE

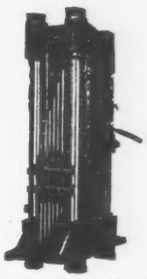


Lead Press for Manufacture of Electrical Cable and Rubber Hose

Over 80 Years of constant research has developed the Watson-Stillman line of

HYDRAULIC MACHINERY

This long experience is your protection against experiment and untried design.



Multiple Plate Heating Press

If you have a production problem on which hydraulic pressure can be used, we have a press that is adapted to your work.

We build complete hydraulic, plants including pipe, valves, pumps, accumulators, intensifiers, and presses, for every purpose such as:

Forming
Dehydrating
Thermo Plastic Moulding
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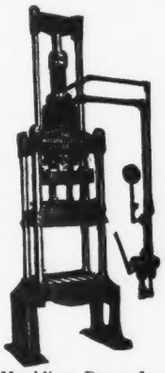

Moulding Press for Plastic Materials

Write for Bulletins

The Watson-Stillman Co.

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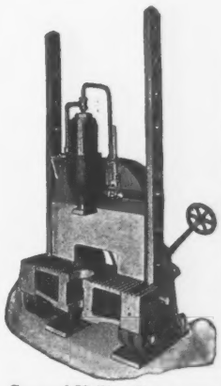

General Utility Press can be used in either Vertical or Horizontal position

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Cut your threads this *modern* way

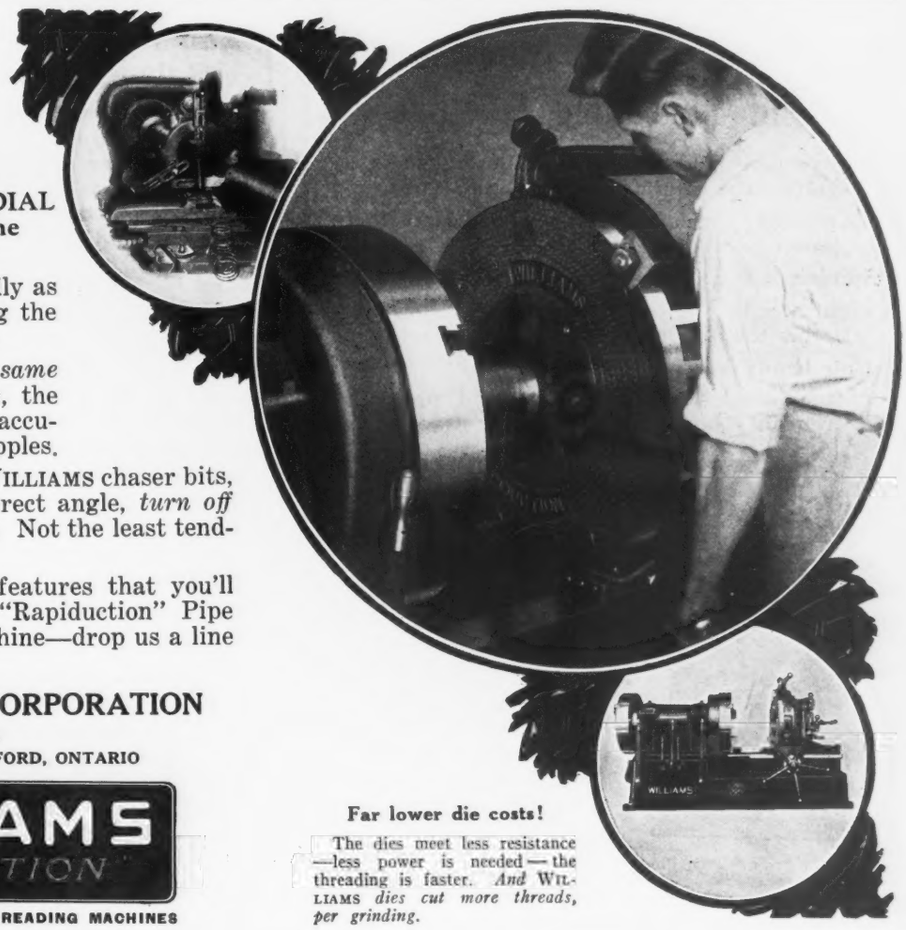
using the same accepted RADIAL principle by which a lathe turns down a shaft

Just as smoothly and easily as a fast modern lathe curling the metal from a steel shaft—

Using exactly the same RADIAL cutting principle, the WILLIAMS dies cut smooth accurate threads on pipe and nipples.

The hobbed threads on WILLIAMS chaser bits, inclined at the exactly correct angle, *turn off the metal by radial cutting.* Not the least tendency to scrape.

There are many other features that you'll like about the WILLIAMS "Rapiduction" Pipe and Nipple Threading Machine—drop us a line for Bulletin "M."



Far lower die costs!

The dies meet less resistance —less power is needed — the threading is faster. *And* WILLIAMS *dies cut more threads, per grinding.*

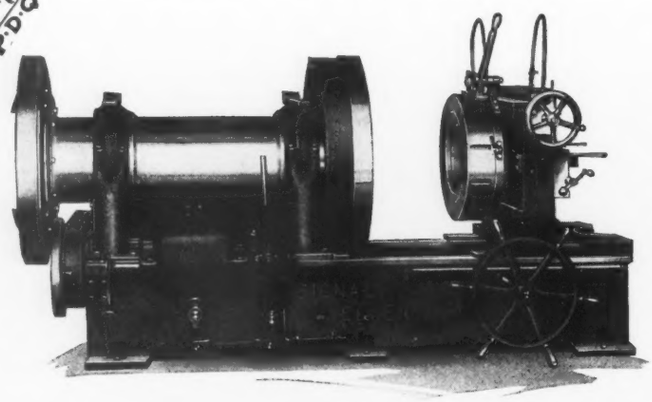
WILLIAMS TOOL CORPORATION

Erie, Pa.

Canadian Plant: BRANTFORD, ONTARIO

WILLIAMS
RAPIDUCTION

PIPE, NIPPLE, AND BOLT THREADING MACHINES



Compare Production

Do you want more threads and better threads at less cost? Many operators of Bignall & Keeler machines with Peerless dies report greater production, in less time with less die cost, less overhead, less sweat and lower labor charge than with any other type of machine or dies.

We do not make extravagant speed claims, but when shop after shop brings the same report, we are compelled to listen.

May we help you investigate?

Bignall & Keeler Machine Works,
of the N. O. Nelson Mfg. Co.
EDWARDSVILLE, ILLINOIS

The New Curtis Pipe Cutting and Threading Machine

Heavy pipe held stationary while light dies revolve—the natural method of pipe threading.

Low power consumption—hand operated where power is not available.

Minimum floor space required.

Light weight—take your machine to the work rather than heavy pipe to the machine.

Cuts bends and crooked pipe readily.

Motors concealed within base and protected from oil, chips and breakage.

No. 442 Motor Driven Pipe Cutting and Threading Machine, range 1—4" R.H.

Write for full details.

HAND - BELT - ELECTRIC
MODELS
Portable 2, 3 and 4 Inch
Others 6, 8, 12 and 16 Inch

THE Curtis
AND CURTIS CO.
Pipe Cutting and Threading Machines

324 Garden St., Bridgeport, Conn.
Find out about wide dies

Anderson Improved Balancing Ways

NO LEVELING REQUIRED

They are made in the following sizes

Swing	Greatest Distance Between Standards	Capacity in Lbs.
20 in.	20 in.	1,000
40 "	30 "	2,000
60 "	30 "	2,000
72 "	66 "	5,000
96 "	88 "	10,000

A simple and excellent device for balancing, straightening and trueing.

Write for full information

Manufactured by
ANDERSON BROS. MFG. CO., 1910 KISHWAUKEE STREET ROCKFORD ILLINOIS

"Forge Ahead with a
Bradley Hammer"

C. C. BRADLEY & SON, Inc., Syracuse, N. Y.
Established 1832

17 STYLES AND SIZES
MERRELL
PIPE THREADING for BETTER threads MACHINES
TOLEDO, OHIO

Fast, Accurate Cutting

For high-speed production and high-quality workmanship no device has been found to equal the

WICACO

Continuous

Oil Groover

Cuts straight, cross, right or left hand helical oil grooves on external or internal surfaces. Inexperienced operators soon reach maximum production on this simple, accurate groover.

Send our engineers samples of what you want and let us show you, by actual test, how the Wicaco will increase your production and lower the unit cost.

WICACO SCREW & MACHINE WORKS INC.
Stenton Avenue and Louden Street
WAYNE JUNCTION, PHILADELPHIA, PA.

Established in 1868

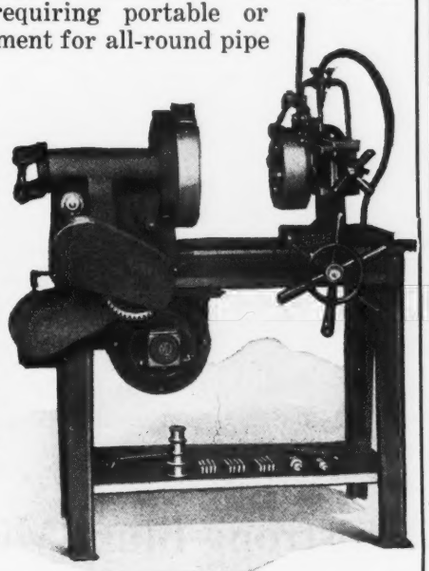
RAYON PUMPS AND EQUIPMENT

Thread and Cut Pipe?

—here's your equipment

The new No. 1 Improved Pipe Threading and Cutting Machine is a motor driven machine, using alternating or direct current, that has found great favor in plumbing, steamheating and industrial establishments requiring portable or permanent equipment for all-round pipe shop use.

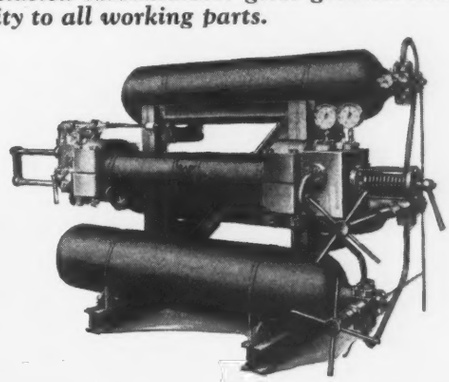
Equipment includes a 1 H. P. constant-speed motor with reversing switch, one adjustable expanding die-head with interchangeable chasers for threading pipe from ¼" to 2" inclusive, rotary oil pump for lubrication, reaming and cutting-off attachment. Machine is adaptable for threading of bolts and use of solid dies. Other machines for all requirements for thread ¼" to 18". Catalogs on request.



D. SAUNDERS' SONS, Inc.
23 Atherton Street **YONKERS, N. Y.**

THE LATEST DEVELOPMENT
FOR
HYDRAULIC PRESSURE SERVICE

The Horizontal Design of Compressed Air Ballasted Accumulator gives greatest accessibility to all working parts.



The greatly improved and absolute uniformity of product has been an agreeable surprise to the most skeptical.

NOT TOO HIGH– NOT TOO HEAVY
NO FOUNDATIONS—NO HEAVY BALLAST

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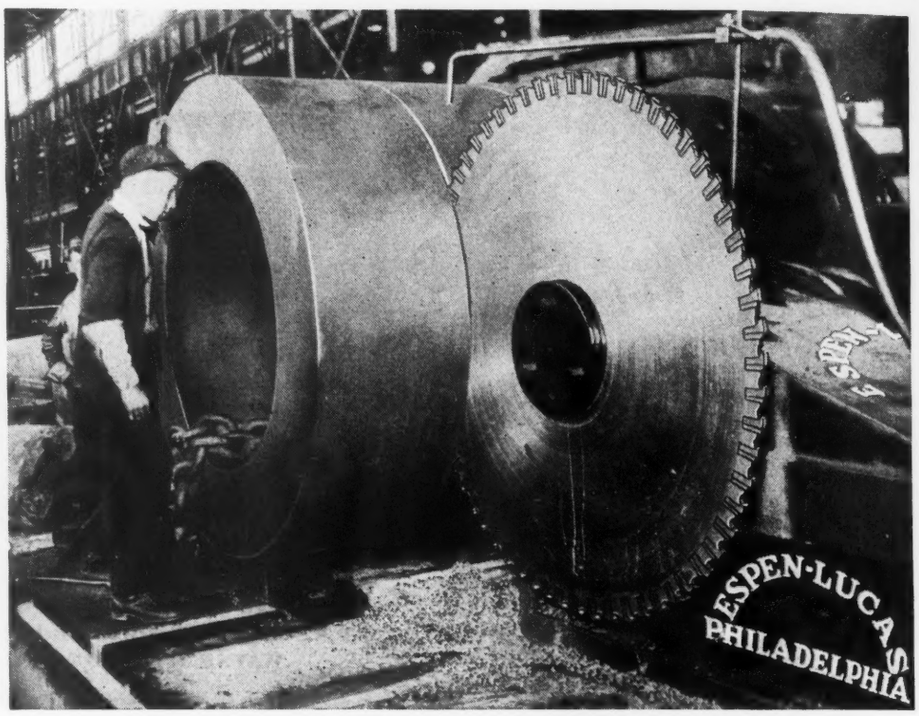
222 N. MORGAN ST. CHICAGO, U. S. A.

E-HYDRAULIC-
PRESSES PUMPS ACCUMULATORS
ELMES
SINCE 1851

FAST AND ECONOMICAL SAWING

Tell us your needs, we have the knowledge, experience and will to correctly advise.

190 types and sizes of Sawing Machines for sawing all kinds of metal.



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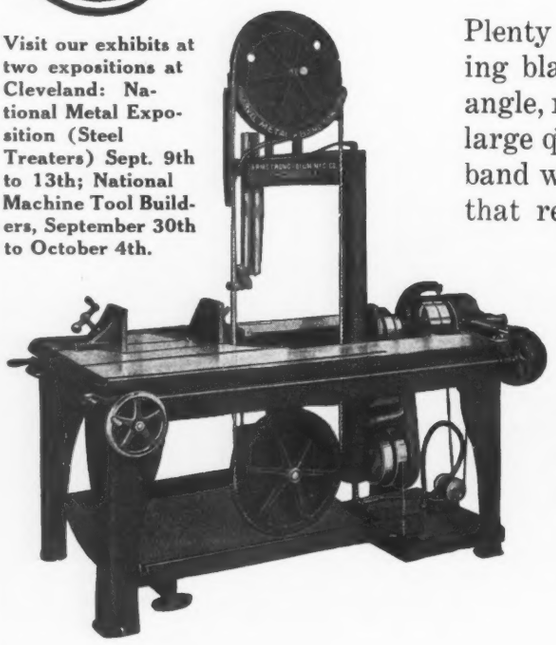
MARVEL

The Marvel No. 8 Metal Band Saw

With Unusual Labor-Saving Features

Visit our exhibits at two expositions at Cleveland: National Metal Exposition (Steel Treaters) Sept. 9th to 13th; National Machine Tool Builders, September 30th to October 4th.

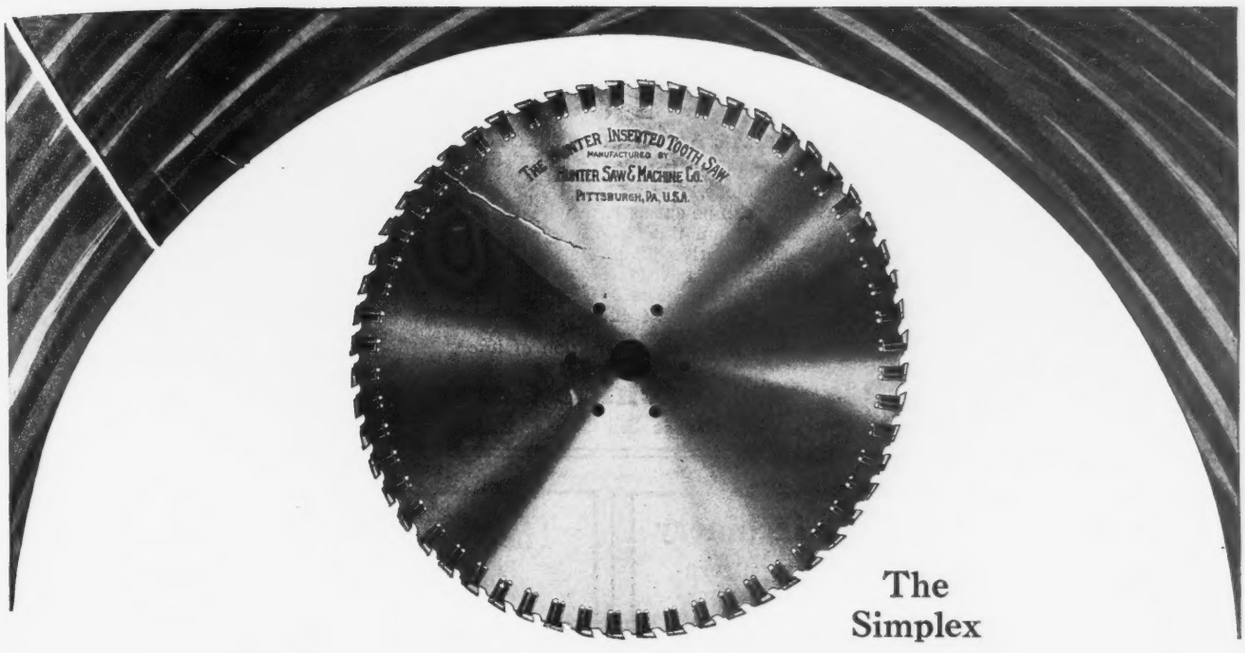


Plenty of room on the bed and work table; a tilting blade frame that cuts off straight or at any angle, right or left, up to 45°; three cutting speeds; large quick-acting vise; 18″ capacity; ball bearing band wheels, carriage and guide rollers; new feed that registers blade pressure in pounds; electric light fixture attached—these are a few of the labor saving features found in the Marvel No. 8 Metal Band Saw.

Accurate, speedy and easy to operate this machine will make real inroads on your sawing costs. Get a complete description and price.

Armstrong-Blum Mfg. Co.

343 N. FRANCISCO AVENUE
CHICAGO, ILL.



The Simplex

HUNTER—

Inserted Tooth Saws

The Simplex

This is an inserted tooth saw without the Hunter adjusting nut device. It is used by a great many manufacturers who grind teeth without removing them from the saw.

This type also provides an easy method of replacement in case of tooth breakage. New tooth rests firmly on base, and if too long may be ground to line up with other teeth—if too short, a liner can be used to get desired height.

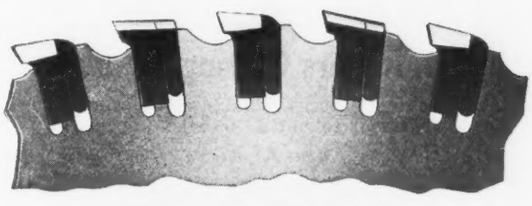
Hunter specializes in cutting-off equipment—and includes machines and blades of all types and sizes in cutting saws. Write for details.

The Duplex

This type of saw, with High Speed Steel Inserted Teeth, offers greater production on work such as large cross sections, heavy forgings, billets, slabs, etc., of tough metals.

Teeth are alternate round and square face, the latter being wider at cutting point to give ample clearance.

Teeth are adjustable on blades of ¼ inch or thicker, by means of a removable half round steel nut and a hexagon head steel screw. This design permits accurate adjustment of teeth and a quick repair in case of broken teeth.

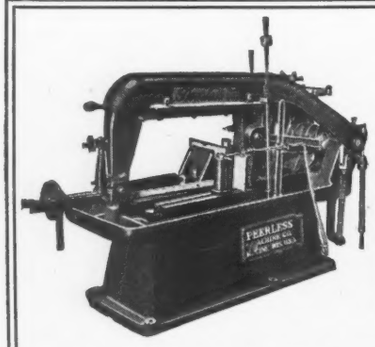


Close-up of Simplex Section

We also manufacture High-Speed Metal Cut-Off Saws, Circular Milling Saws, Pneumatic Hammer Rivet Sets, Chisel Blanks and Hardened Steel Specialties.

HUNTER SAW AND MACHINE CO.

5662 BUTLER STREET, PITTSBURGH, PENNA.



Peerless

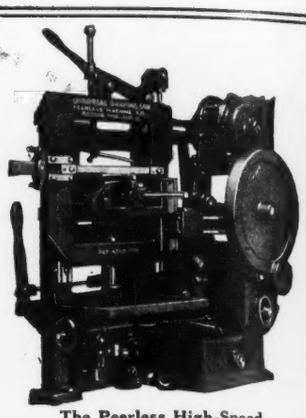
TIME-SAVING ACCURACY

The accuracy of Peerless Sawing Machines is remarkably close. Gear Blanks, for example, *in one operation*, can be cut so parallel that they are ready for finishing on the Arbor. Straight line pull on blade and positive blade clamp keep metal waste at a minimum, greatly reducing machining operations and sawing costs. Many important features, including automatic feed.

Write for description of line

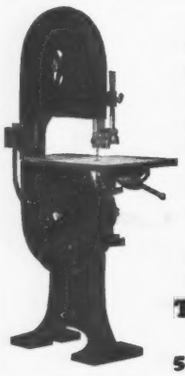
Send for details of Peerless High-Speed Universal Machines. Peerless High-Speed Metal Saws and other Peerless Cutting-Off Machines.

Peerless Machine Company
1218 Sixteenth Street **RACINE, WIS.**



The Peerless High-Speed Universal Shaping Saw.

Crescent Wood Working Machinery



Save time in your pattern-shop by providing each workman with individual small Crescent machines. The line consists of band saws, saw tables, jointers.

The saving in time and the convenience to your men will be highly profitable to you. Ask for catalog.

The 20" Crescent band saw is one of the machines that will save money for you.

THE CRESCENT MACHINE COMPANY
56 Main St., Leetonia, Ohio, U. S. A.

The "JARVIS" Bench Band Saw

For Metal Cutting Operations

The "Jarvis" Bench Band Saw cuts metals—straight, curved or bevel. It is motor driven, operates from a lamp socket and is vibrationless. Ball bearing disc wheels, worm drive.

12" size cuts up to 1½" cold rolled steel. 16" size cuts up to 2" cold rolled steel. Also made for cutting soft metals, Bakelite, fibre, transite, wood, etc.

Details gladly sent upon request.

BENJ. E. JARVIS, Inc.
NEWARK **NEW JERSEY**
Walls Sales Corp., Agents
96 Warren St. New York City

Set these packs of Lenox Wolves on the trail of your toughest jobs!

Thousands of shops the country over—shops whose work demands of hack saw blades the very finest quality that money can buy—have turned to these packs of rangy, rugged, super-strong Wolves of Lenox.

If you are looking for long-lasting, keen edges—for blades that cost less because they cut more, just ask for

"The Tools in the Plaid Box"

AMERICAN SAW & MFG. COMPANY
Springfield, Mass.

A product by the makers of the famous Wolves of Lenox—hack saw blades. Send for a copy of "The story of the Wolves of Lenox."

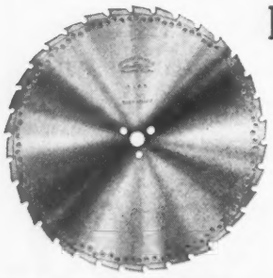
DRILL SHARPENER

Designed along entirely new lines.—Can be built to sell for approximately $140.00. This machine is available for manufacture by responsible organization on a royalty basis; or manufacturing rights can be purchased.

Write for information

Chas. J. Bernauer Mfg. Company
534 Desplaines Avenue
Forest Park, Ill.

Lowest Cost per Cut with HUTHER SAWS



The special inserted teeth of high speed steel make Huther Saws profitable and economical. Inserts give 1¾" wear before replacing—and replacements cost but little. The saws are shaped to give proper clearance to the teeth at all times.

The Huther line covers saws for every purpose. You can try one at our expense. May we send it?

HUTHER BROS. SAW MFG. CO., Inc.
ROCHESTER, N. Y.

Hurlbut, Rogers Cutting-off Machines

Have patented features found in no other machines; speeds and feeds to suit all metals. Capacity to 10" stock.

Write for catalog

THE HURLBUT, ROGERS MACHINERY CO.
Nashua, N. H.

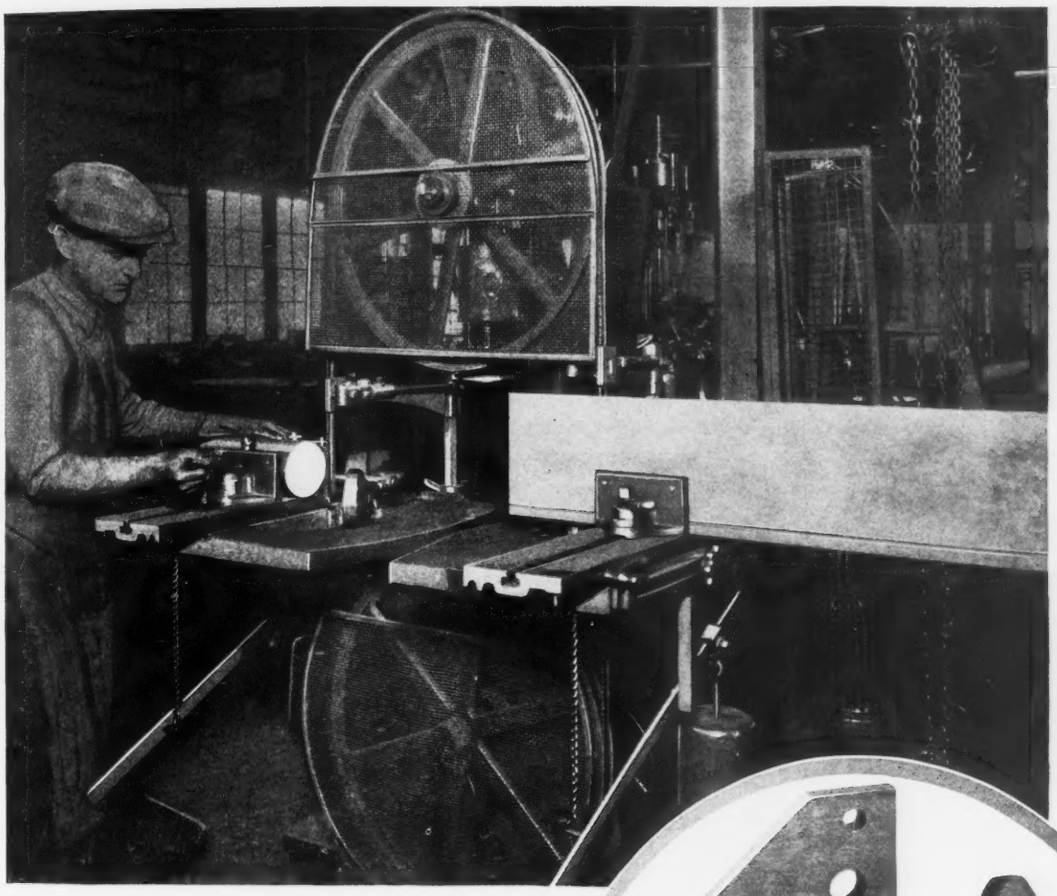
What To Broach and How To Do It Most Profitably—

For details—write the

AMERICAN BROACH & MACHINE CO.
Ann Arbor, Michigan

Builders of All Types of Broaching Machines and Broaching Tools

THE LAIDLAW COMPOUND METAL CUTTING BAND SAW



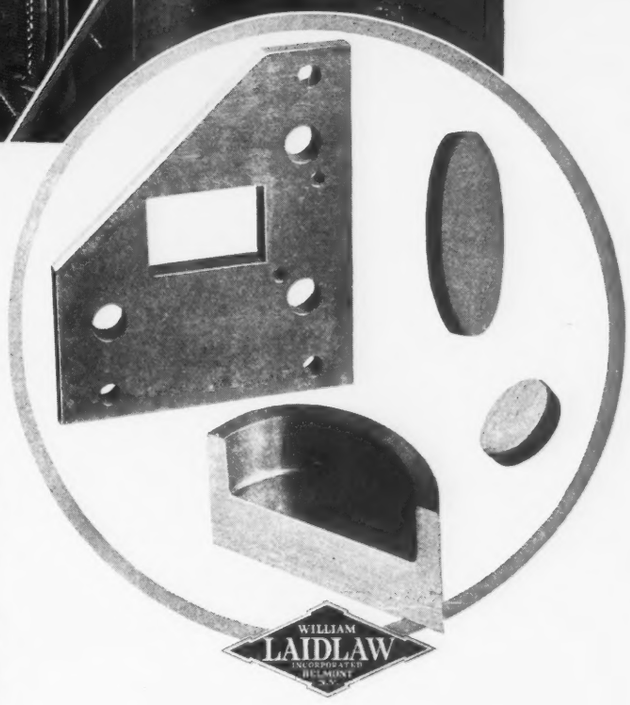
Saves Two Machines Reduces Production Time and Increases Quality

It has taken this Laidlaw Compound Metal Cutting Band Saw only seven months to earn the hearty endorsement of the Detroit Stamping Co., Detroit, Mich.

Replacing three other well-known machines on general work in steel and other metal parts, it has proven far superior in every way—wider capacity, speedier, more accurate and cleaner cutting on work ranging from ½" round to 14" flat.

Again the principle of band-saw cutting—long preferred by the wood-working industry—proves equally efficient on metal cutting. And again the exclusive Laidlaw Compound design, permitting two jobs to be handled simultaneously, replaces a battery of ordinary equipment.

Another feature of the Compound—the *vertical* band saw—deserves mention. This position permits handling 90% of all work without bending the saw, and not only results in far greater accuracy but adds mightily to the life of the saw.



Use Laidlaw Compound Metal Cutting Band Saws for speed, accuracy and economy. All details on request.

WILLIAM LAIDLAW, Inc., Belmont, New York

This New Metal Saw Saves You Time and Money

It will pay you well to investigate the NEW SIMONDS RED STREAK INSERTED TOOTH METAL SAW. This is the most efficient metal saw ever produced because it does so much faster cutting and retains its edge longer. Much of its extraordinary success is due to the quality steel and scientific shape and arrangement of the teeth. Deep gullets curved in the right way chamber the chips and expel them from the cut without welding or sticking to the plate or sides of the teeth.

To see this saw in operation as it slices through the hardest kind of metal is a pleasure for any mechanic.

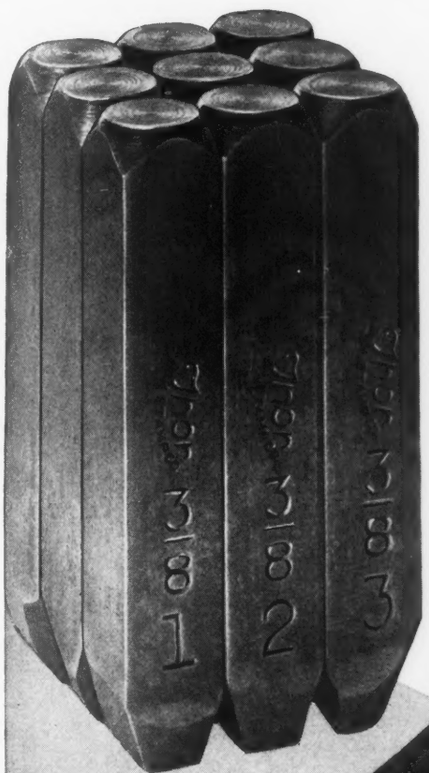
Before you buy, investigate the possibilities of this saw on your work.

Simonds Saw and Steel Co.

ESTABLISHED 1832 — FITCHBURG, MASS.

Chicago, Ill.	Memphis, Tenn.	Seattle, Wash.
Boston, Mass.	Atlanta, Ga.	Montreal, Que.
Detroit, Mich.	London, Eng.	Toronto, Ont.
New York City	Portland, Ore.	Vancouver, B. C.
New Orleans, La.	San Francisco, Cal.	St. John, N. B.
Lockport, N. Y.	Los Angeles, Cal.	

Not Another Stamp—
A Better Stamp!



Steel marking stamps, just like any other kind of shop tools, vary in quality and efficiency. Designing skill, careful workmanship and the proper selection of raw materials are as important in a stamp as in a lathe.

Thors, naturally, carry out this idea. Made from the best grade Special Vanadium Alloy high carbon tool steel, scientifically tempered and hardened, as the characteristic blue color head indicates, they possess the stamina to stand up under the hardest usage. Features of design include central striking point, "thumb marking" for ready identification and deeply engraved characters.

"Thor" Stamps' first cost is more, but when you buy them we let you write your own guarantee. Send for our circular.

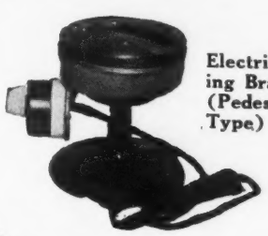
Thor

"The Stamp With a Blue Head"

THE PITTSBURGH STAMP CO.

810 Canal St., Pittsburgh, Pa.

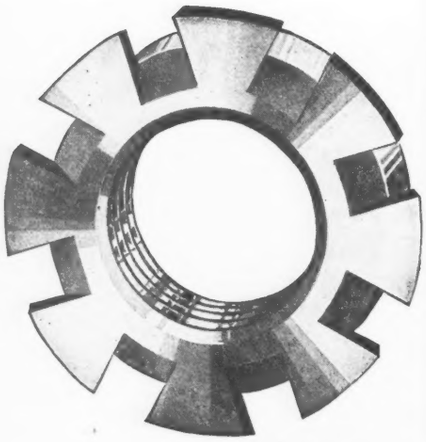
Makers of Thor Marking Tools

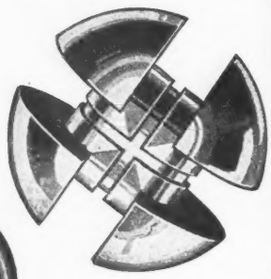


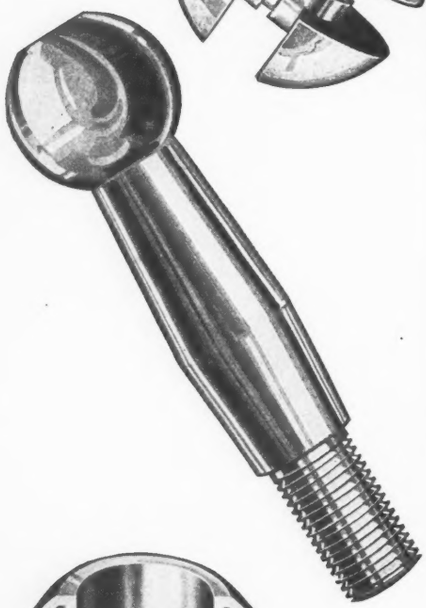
Electric Burning Brand (Pedestal Type)

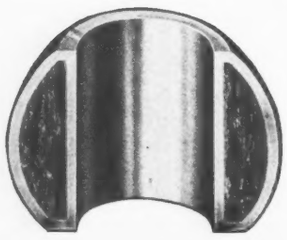
Three Line Stamp Holder

Steel Press Die









Increased Production and Lower Costs

CARNEGIE Open Hearth Manganese Screw Stock is a low carbon, high manganese, high sulphur steel with exceptional machining qualities and unusual case hardening properties. It combines free cutting quality closely approximating Bessemer Screw Stock with physical properties much superior to S.A.E. 1020 grade. Some automatic machine operators prefer it to Bessemer on account of its consistent uniformity. Its free cutting quality assures longer tool life and more continuous machine operation.

Suitably treated, a fine grained, uniformly hard case and tough ductile core can be obtained. The high manganese content insures a clean steel and aids in the carbon penetration, thus securing the desired depth of case in shorter time at carburizing temperature, and resulting in increased production and saving in fuel and pot costs. Carnegie Open Hearth Manganese Screw Stock is also obtainable in higher carbon ranges up to .50% where machineability and increased physical properties are important factors.

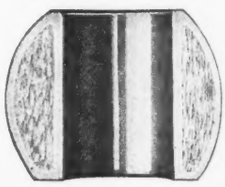
The parts shown on this page were all made of Carnegie Screw Stock, cold drawn by a prominent manufacturer of shafting and cold finished steels.

CARNEGIE STEEL COMPANY

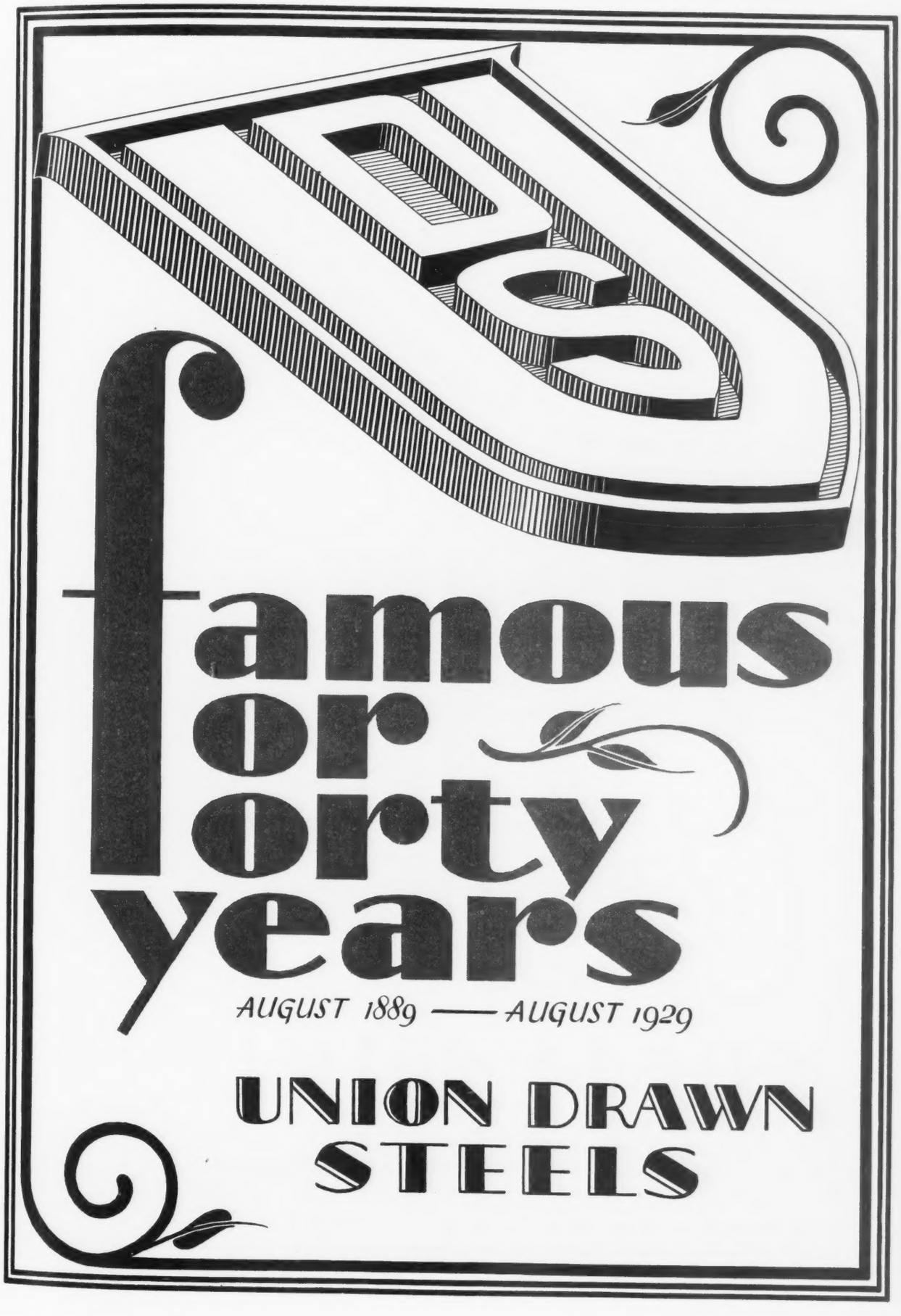
Subsidiary of United States Steel Corporation

PITTSBURGH, PA.

17



CARNEGIE MANGANESE STEELS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for
forty
years
AUGUST 1889 — AUGUST 1929
UNION DRAWN
STEELS

Steel Sheets

For Machinery Parts, Guards, Stampings, Etc.

AMERICAN SHEET AND TIN PLATE COMPANY PITTSBURGH
TRADE MARK REG. U.S. PAT. OFF.

This Company is the largest and oldest manufacturer of Black and Galvanized Sheets, Automobile Sheets, Deep Drawing Sheets, Stamping Stock, Sheets for special requirements, Keystone Rust-Resisting Copper Steel Sheets, Long and Short Ternes, Bright Tin Plate, Black Plate, Etc., for all uses in the machinery construction field. For utility and satisfaction use AMERICAN products—highest quality obtainable.

The products of this Company represent highest standards of quality and service. *Made right—Sold right!*
CONTRIBUTOR TO
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AMERICAN
STEEL SHEETS *for* Every Purpose

DISTRICT SALES OFFICES: Chicago, Denver, Detroit, Cincinnati, New Orleans, New York, Philadelphia, Pittsburgh, and St. Louis. Write nearest Sales Office for information and booklets.

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American Sheet and Tin Plate Company
General Offices: Frick Building, PITTSBURGH, PA.
SUBSIDIARY OF
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Quality Products — *Dependable Service*

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HAWKRIDGE BROS. STEELS *and* SERVICE

In Stock

- High Speed Steel
- Machinery Steels
- Spring Steels (Alloy and Carbon)
- Crucible Tool Steel
- Oil-Hardening or Water-Hardening
- Hot-rolled or Cold Drawn
- High Carbon or Low Carbon
- Rough Turned or Drill Rod Finish
- Heat-Treated or Annealed
- Alloyed or Plain Steel in Rounds, Squares, Flats, Hexagons, Octagons and Special Shapes.
- Cumberland Turned and Ground Shafting

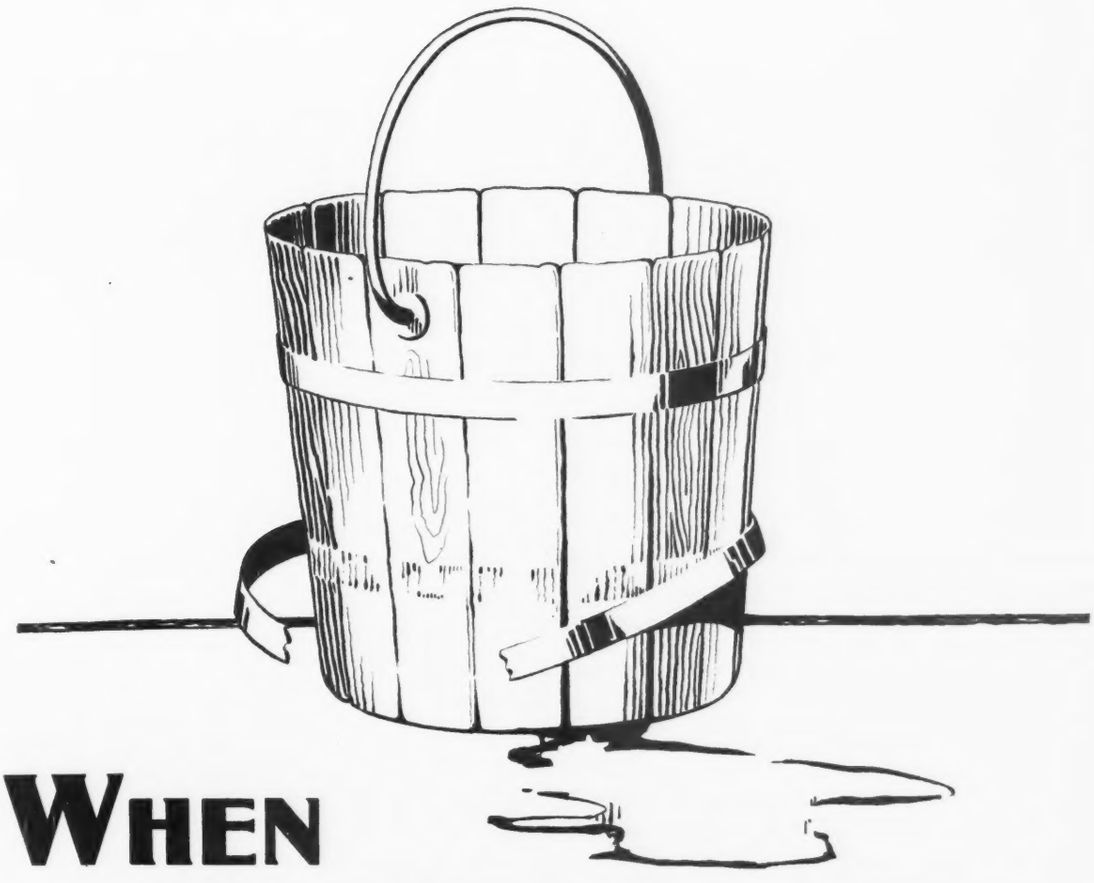
What Users Want—

Quality steels and service of a character that insures a continuous and unvarying supply of the *correct steel* for each job.

Hawkridge Steels and Service help eliminate a fundamental production problem; enable Hawkridge customers to *guarantee* the quality and uniformity of steels incorporated in their products.

If your plant is in New England; ask us for the steels you want.

HAWKRIDGE BROS. COMPANY
303 Congress Street, BOSTON, MASS.



WHEN A BUCKET LEAKS ▲▲▲

it takes no expert to discover the fact. But when leaks occur at the "business end" of an expensive machine tool, dollars are lost before the real cause is discovered.

The best machine tool you can buy, with its high production capacity, cannot perform at maximum efficiency if the tool does not match it in ability. Consider the tool! The price of the highest quality tool steel, the grade best suited to your work is so little in proportion to your machine investment, that the few cents saved on "bargain" steel make the risk of its use prohibitive.

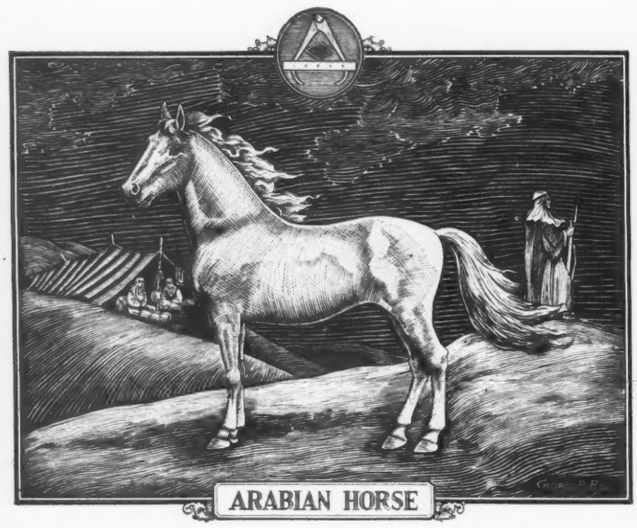
COLONIAL TOOL STEEL

Every facility of modern metallurgy, every known safeguard is employed to make Colonial Tool Steel a fit accessory to the most up-to-date machines. We know there is no better steel than Colonial at any price. To consider it is to try it; to try it is to become a steady Colonial user.

COLONIAL STEEL COMPANY

Pittsburgh Cleveland Boston Buffalo Detroit Salt Lake City New York Los Angeles St. Louis Cincinnati Chicago Philadelphia

"CONSIDER *the* TOOL"



QUALITY

A characteristic of the Arabian Horse and also of the products manufactured by The Garlock Packing Co., Palmyra, N.Y.

ARABIAN horses were originally obtained from the Libyan tribes of Northern Africa. By long and careful mating the superior type has been maintained through many centuries. The breeding and raising of the Arabian horse is closely supervised and controlled by the owners so as to obtain certain desirable qualities such as endurance, strength, intelligence, tractability and fine appearance.

Realizing that quality in commodities, as well as in domestic animals, is secured by years of close supervision of details, The Garlock Packing Company has continually striven in the past quarter of a century to build products whose body structures and treatments are basically right to meet the requirements of an economical and satisfactory packing service.

This fundamental characteristic of Garlock manufacturing processes has merited the descriptive name *Quality Controlled Packings* for their products.

Fine BOKER Steels and Tools

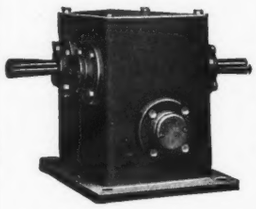
KEYLESS Drill Chuck

1. Hand Operated.
2. Ball Bearing action.
3. Perfectly balanced and concentric in operation.
4. Drills cannot slip.

Try one for 30 days.

H. BOKER & CO., Inc.
103 Duane Street, NEW YORK CITY
BOSTON CHICAGO CLEVELAND

2500 to 1!



W H S No. 4 D Reducing Gear

The new W H S No. 4D Reducing Gear will give a ratio of reduction as large as 2500 to 1.

Send for special circular, also for catalog No. 23 showing a complete line of W H S Reducing Gears of small H.P. capacity.

WINFIELD H. SMITH, Inc.
116 Eaton St., Springville, Erie Co., N. Y.

HIGH SPEED, CARBON, ALLOY TOOL STEELS
OF QUALITY OUR SPECIALTY
Vanadium Alloys Steel Co.
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SEALS.
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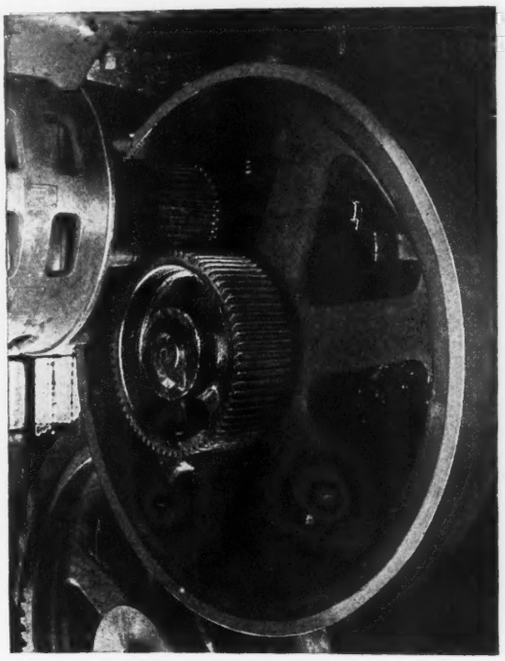
THE SCHWERDTLE STAMP CO.
ESTABLISHED 1879
39-45 CANNON ST. BRIDGEPORT, CONN.

WHERE MICARTA GEARS ARE GOING



MICARTA

Silent
Gears and Pinions

Manufacturer
Distributors

—

ALA. Birmingham
Moore-Handley Hardware Co.
Chas. C. Steward Machine Co.

CALIF. Los Angeles
Los Angeles Automotive Works

San Francisco
Pacific Gear & Tool Works

COLO. Denver
Colorado Gear Mfg. Corp.
Stearns Roger Mfg. Co.

ILL. Chicago
Foote Bros. Gear & Machine Co.
Gears & Forgings, Inc.
D.O. James Mfg. Co.
A. Plamondon Mfg. Co.

MD. Baltimore
Murrill & Keizer Co.

MASS. Boston
Grant Gear Works

Springfield
Perkins Machine & Gear Company

Worcester
Beacon Gear Shop

MO. Kansas City
United Iron Works

N.C. Gastonia
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N.J. Elizabethport
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Paterson
Watson Machine Co.
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N.Y. Brooklyn
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Buffalo
A. F. Oliver Gear & Machine Co., Inc.

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Deifendorf Gear Corp.

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TEXAS Houston
Houston Armature Works

WASH. Seattle
Western Gear Works

A MICARTA Pinion

REG. U.S. PAT. OFF.

absorbs the shocks of this Punch Press

HERE is work that would prove quite a task for ordinary gears, but Micarta gears take the shocks incident to the operation of punch presses, planers and other heavy machine tools, day after day, year in and year out without failure or appreciable wear. The resilient character of Micarta gears prevents breaking of the teeth, besides, Micarta gears are silent, thus reducing clatter and nerve strain. Because they are self-supporting, Micarta gears can be made in one piece, in any size up to ten inches in width, without the use of shrouds.

Another valuable characteristic of Micarta is that it is not affected by moisture, oil or acid fumes.

A copy of gear circular 1579-F will be sent to anyone interested in silent gear design. Address our manufacturer-distributors or the nearest Westinghouse office.

WESTINGHOUSE ELECTRIC & MFG. COMPANY
EAST PITTSBURGH PENNSYLVANIA

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Westinghouse

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Automatic Electric Babbitt Pots
Babbitt and Solder
Capacitors
Circuit-breakers
Electric Heating Apparatus
Fans
Fuses
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Lighting Equipment
MAZDA Lamps
Micarta Gears
Motor-generators
Motors and Control
Panelboards
Safety Switches
Speed Reducers
Switchboards
Tool Room Furnaces and Ovens
Transformers

Standardize Your Worm Gears

—it can save you money

Some Pittsburgh worm gears and a few of the hobs that cut them.

Designing your worm gears to conform, whenever possible, to the standards of the American Gear Manufacturers' Association, not only assures you of the highest efficiency but can very often save you considerable money.

For example, we have an unusually complete stock of worm gear hobs, and standard sizes, requiring no new equipment, can be made at much less cost than those which require hobs of special design.

These hobs cover a range of all sizes from 2 D. P. to 12 D. P.—complete dimensions will be furnished upon request, together with valuable data relating to the design of worms and worm gears, consisting of tables showing the recommended proportions of diameters, widths, pressure angles, worm lengths, etc., adopted by the American Gear Manufacturers' Association.

We are distributors for the General Electric Co., and can give 48-hour service on Fabroil and Textolite Gears.

PITTSBURGH GEAR & MACHINE CO.

2700 Smallman Street, PITTSBURGH, PA.

MEMBER OF AGMA

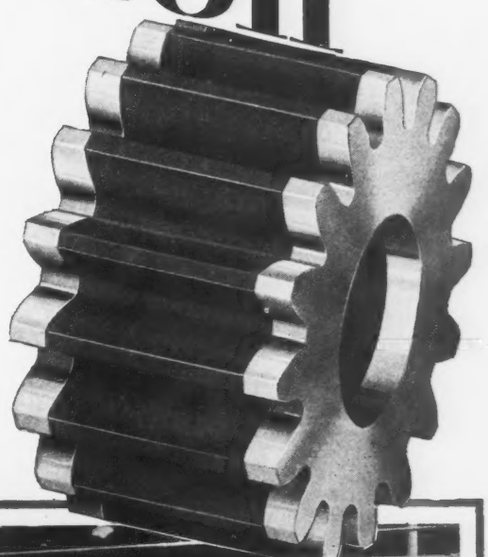
PITTSBURGH GEARS

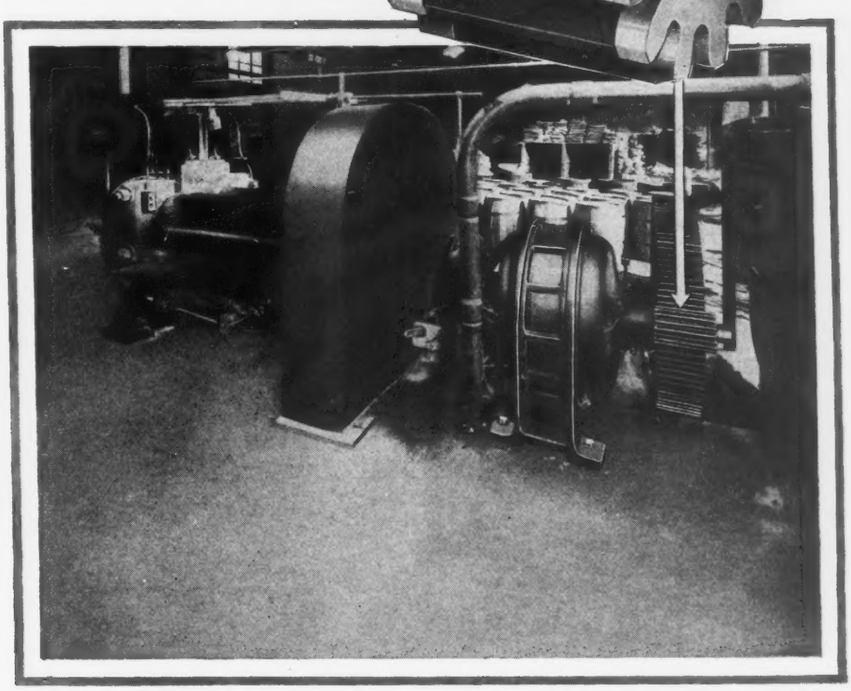
Give your toughest pinion jobs to Fabroil

SO SEVERE is the service on this Thropp rubber mill at the Schwarzwaelder Rubber Company, Philadelphia, that ordinary pinions fail in two months.

To put an end to incessant pinion replacements, to quiet the howl of metal clashing with metal, and to save the machine from racking vibration, this company changed to Fabroil pinions. To-day, after a year and a half of service, the Fabroil shows no sign of wear, the machine is quiet, and operates smoothly.

Call up your nearest distributor and ask him to tell you more about Fabroil.





Distributors for G-E Non-Metallic Gears

Boston Gear Works, Norfolk Downs, Mass., with branches in Boston, New York, Cleveland, Chicago, and Philadelphia
Chicago Rawhide Manufacturing Co., Chicago, Ill.
Cincinnati Gear Co., Cincinnati, O.
Crago Gear & Machine Works, Kansas City, Mo.
Diefendorf Gear Corp., Syracuse, N.Y.
Foote Bros. Gear & Machine Co., Chicago, Ill.
Gears & Forgings, Inc., Cleveland, Ohio, with branches in Chicago, Pittsburgh, Detroit, and Buffalo
Horsburgh & Scott Co., Cleveland, O.
Johnson Gear Co., Berkeley, Calif., with branches in Los Angeles and San Francisco
The Medart Co., St. Louis, Mo.
Michigan Gear and Engineering Co., Detroit, Mich.
Philadelphia Gear Works, Phila., Pa., with branch in New York City
Pittsburgh Gear and Machine Co., Pittsburgh, Pa.
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J. Zagora Machine and Parts Co., Charlotte, N. C.

830-64

JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY SATURDAY AT 8 P.M., E.S.T. ON A NATION-WIDE N.B.C. NETWORK

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES

Larger Bevel Gears

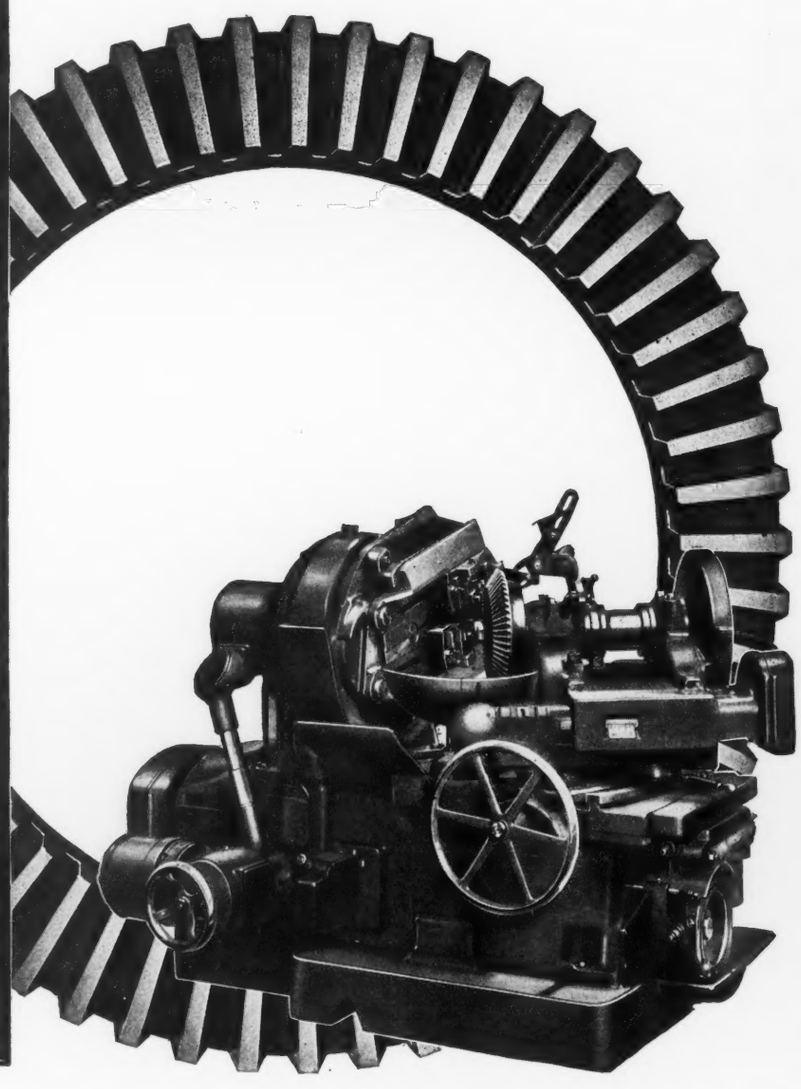
Can now be cut on the 12″ Straight Bevel Gear Generator

The capacity of this machine has been increased to accommodate a 10 to 1 ratio, 3½″ face, 24″ pitch diameter gear. The largest mitre gear (3½″ face) that can be cut is 17″.

Tool speeds and feeds have been increased. Feeds (time per tooth) are available from 7.6 seconds to 1 minute, 26 seconds.

The 12″ Straight Bevel Gear Generator is fully universal, quickly set up and automatic in operation. Due to its rugged design, both rough and finish cutting can be performed on this machine and the change is easily and quickly accomplished. When gears are roughed in large quantities, the double indexing method by which two tooth spaces are roughed at one time, can be employed.

Full information, including actual production time if blueprints are sent, will be furnished on request.



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Manufacturers of Bevel Gear Machinery for Over Sixty Years

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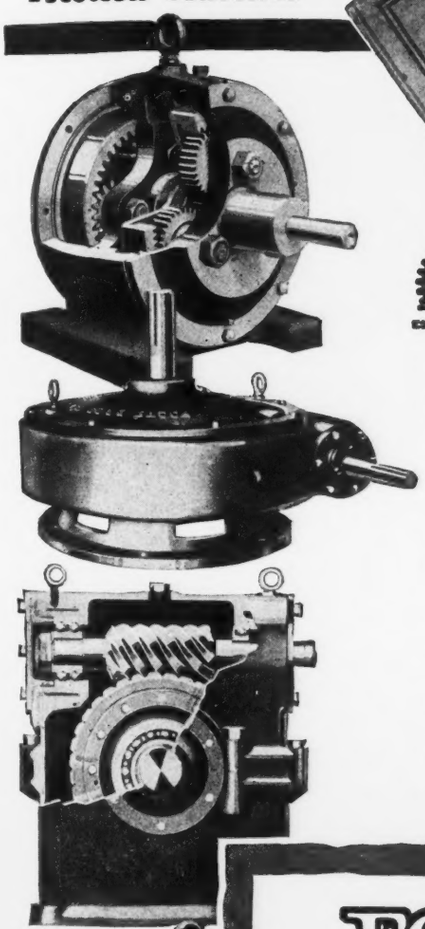
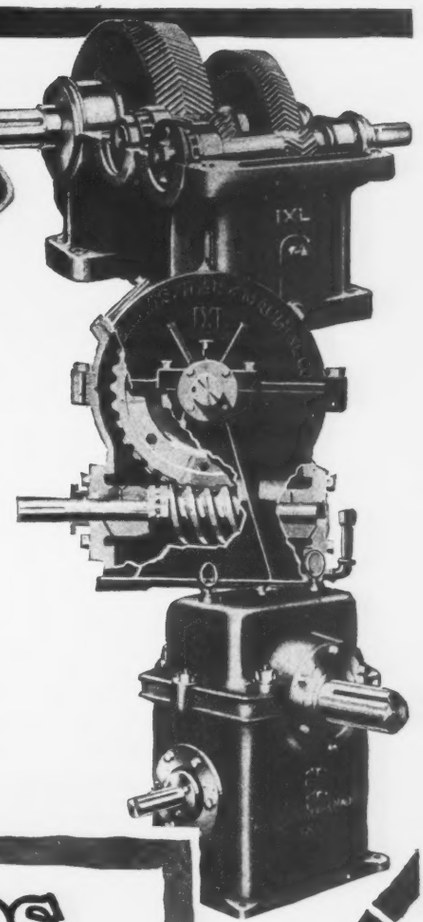
BRITISH ISLES, *Buck & Hickman, London*; JAPAN, *Andrews & George Co., Tokyo*; INDIA, *Alfred Herbert (India) Ltd., Calcutta*; GERMANY, CZECHOSLOVAKIA, AUSTRIA, HUNGARY, RUMANIA, JUGOSLAVIA AND POLAND, *Bohm & Bormann G.m.b.H., Berlin-Tempelhof*; ARGENTINE, *Negroni Hermanos, Buenos Aires*; SCANDINAVIA, FINLAND AND THE BALTIC STATES, *Aktiebolaget V. Lowener, Stockholm*; RUSSIA, *Amtorg, Kuznetsky Most, 22 Moscow*; FRANCE, BELGIUM, PORTUGAL, ITALY, SWITZERLAND AND SPAIN, *Fenwick Freres & Co., Paris*; AUSTRALIA, *Alfred Herbert, Ltd., Sydney, N.S.W.*

IXL Speed Reducers to meet all your needs

Flexible Couplings
Friction Clutches

IXL Transmission Equipment
Gears of all Kinds



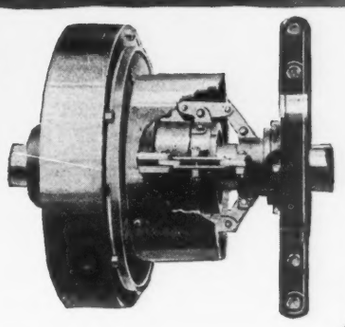


SEND for your copy of "Gear Problems" if you have not already received one.

661 pages of data and information on all types of speed reducers and gears for use in every industry.

Contains over 200 pages of valuable Reference Tables — Data — Formula and Problems.

Our engineering department is always at your service, to help solve and plan unusual problems involving speed reduction or gears, without any obligation.



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Sales and Engineering Offices in all Principal Cities, U. S. A. and Canada

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FOOTE BROS. GEAR & MACHINE CO.
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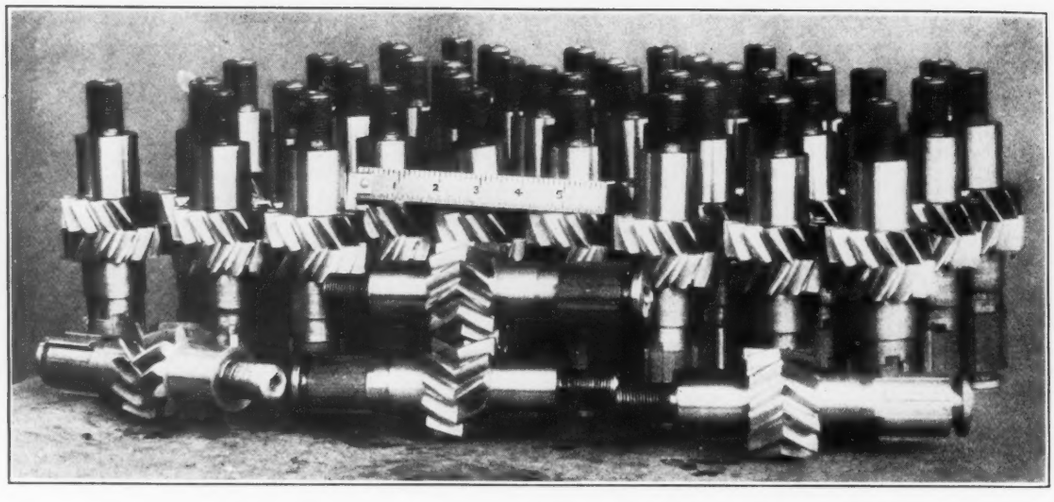
Send me a copy of "Gear Problems"

Signed _____

Address _____

8-29

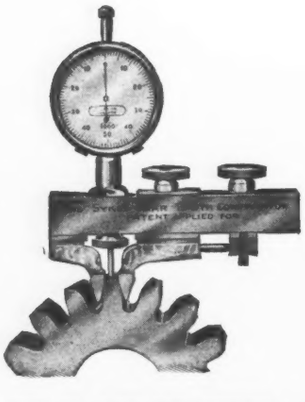
Smooth, Silent Running Gears for Parallel Axes are Rapidly Generated on Sykes Gear Generators



OCCASIONALLY the question arises, "Why use *'herringbone'* gears"? There are a number of reasons: there is the greater strength and durability, the gradual tooth contact, the freedom from end thrust, and the exceptional accuracy when cut on Sykes gear generators. There is the assurance of uniform angular velocity and freedom from chatter, and there are many more reasons involving technical explanations.

The best thing to do is to turn a pair of blanks and send them to us for cutting. Size is no object. We cut them from 16 DP upwards.

Then, if the gears come up to expectations and you use enough of them, a Sykes gear generator is available so that you may control your own production.

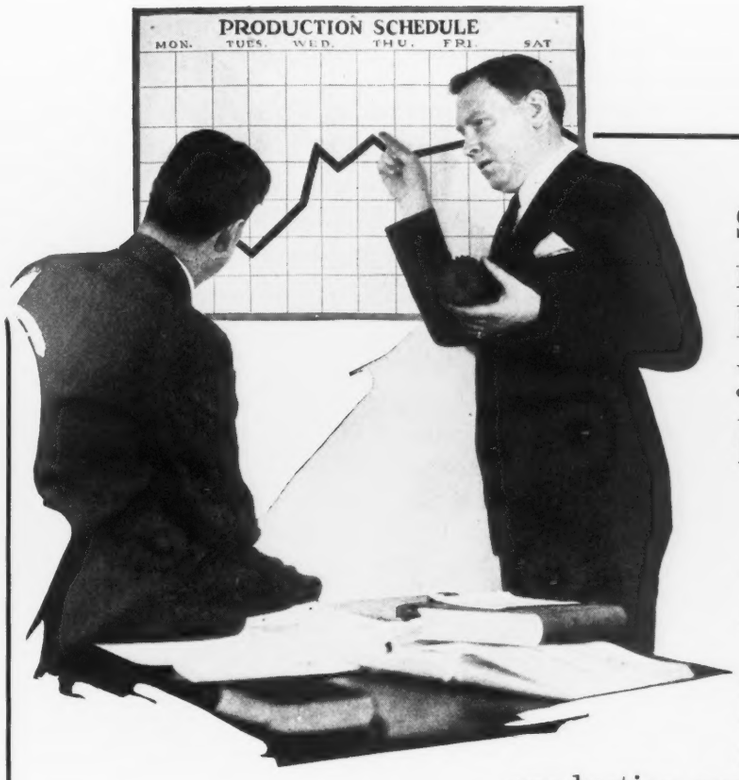


The Sykes Gear Tooth Comparator

This instrument is indispensable for the production of accurate gears. It will gauge the teeth to within .0005″ and show errors from tooth to tooth. And it never wears out.

FARREL-BIRMINGHAM CO. Inc.

SUCCESSOR TO
FARREL FOUNDRY & MACHINE CO., ANSONIA, CONN., AND
BUFFALO, N. Y., AND BIRMINGHAM IRON FOUNDRY OF DERBY, CONN.
ADDRESS INQUIRIES FOR GEARS AND REDUCERS TO BUFFALO PLANT
344 VULCAN ST., BUFFALO, N. Y.



Slow Delivery never holds up Production when you Specify PHILADELPHIA GEARS

You can count upon the on-time delivery of the gears you need, by ordering from Philadelphia. For quality gears, in quantities for production purposes,—or a single gear to meet an emergency, Philadelphia Gears will best suit your requirements.

Philadelphia Gears are "rejectionless"—in other words, our method of inspection from start to shipping eliminates every defective gear before it leaves our shop. This SAVES YOU time and trouble.

PHILLIE GEAR

Power Saving Products

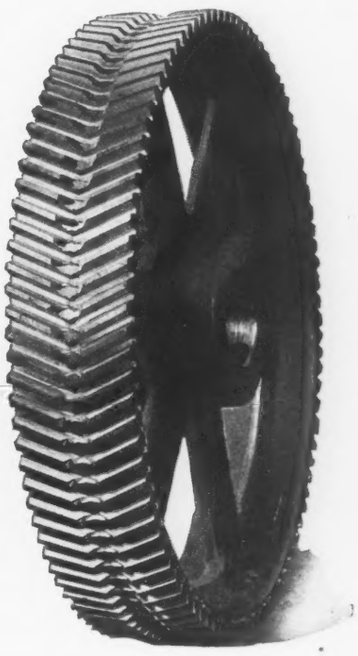
GEARS: Spur, Worm, Herringbone, Internal, Bevel, Miter, Intermittent, Spiral, Helical. Continuous Tooth Herringbone Gears.

NON-METALLIC PINIONS: Fabroil, Textolite, Rawhide.

Whitney Silent and Roller Chains, Sprockets, Flexible Couplings, Universal Joints, Racks, Ratchets and Pawls, and a complete line of gear driven— SPEED REDUCING UNITS

MEMBER A.G.M.A.

Why not let us solve all your gear problems? We've been doing it for others for 50 years—"we know how."



Main Office and Plant Erie Ave. and G St. Phila., Pa.

PHILADELPHIA GEAR WORKS

Manufacturers of Industrial Gears and Speed Reducing Units

PHILADELPHIA, PENNA.

Branch Sales and Engineering Offices:
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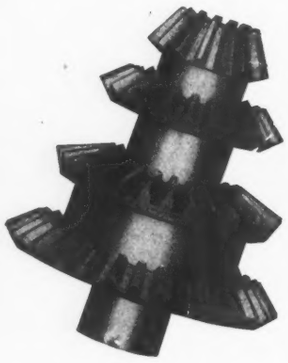
Good Gears for Every Purpose

Where Silence Is a Factor—Formica!



Every purpose in service, but single purpose in results—the efficient handling of the job.

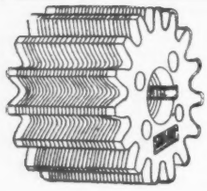
Made in a wide range of sizes—⅛″ to 36″—in all types, all materials, including Formica. A staff of engineers, backed by 20 years' experience, is here to assist you without charge. They have aided leaders in all lines to perfect their gearing, and can materially assist you.

The Crofoot Service is worth a trial. Send in your specifications for a convincing estimate.

Charles E. Crofoot Gear Corp.
65 Central St., South Easton, Mass.

Pioneer of ACMA
American Gear Manufacturers Association

GEARS BY CROFOOT



Gears, Mallets from Tough

"Chicago Rawhide"

Here you have the toughest and most durable in Gears and Mallets — two "Chicago Rawhide" products.

"Chicago Rawhide" Gears and Gear Blanks are elastic, noiseless, long-lived, economical and strong.

Our "Chicago Rawhide" Mallets and Hide-Faced Hammers are non-conductors—they can't damage fine surfaces or soft metal work—just what you've been looking for. We also make Belting, Lace Leather, Cut Lacing, Hydraulic Packing.

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Manufactured in 37 Factories

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Thirteenth Year

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GEARS

Rawhide Bakelite and hardened steel pinions. Your blanks cut to specifications. Don't fail to get our prices. QUALITY—SERVICE.

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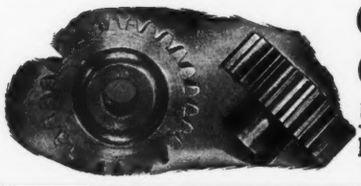

Gears and Gear Cutting

We guarantee satisfaction

RODNEY DAVIS
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Bevel Gear Generators

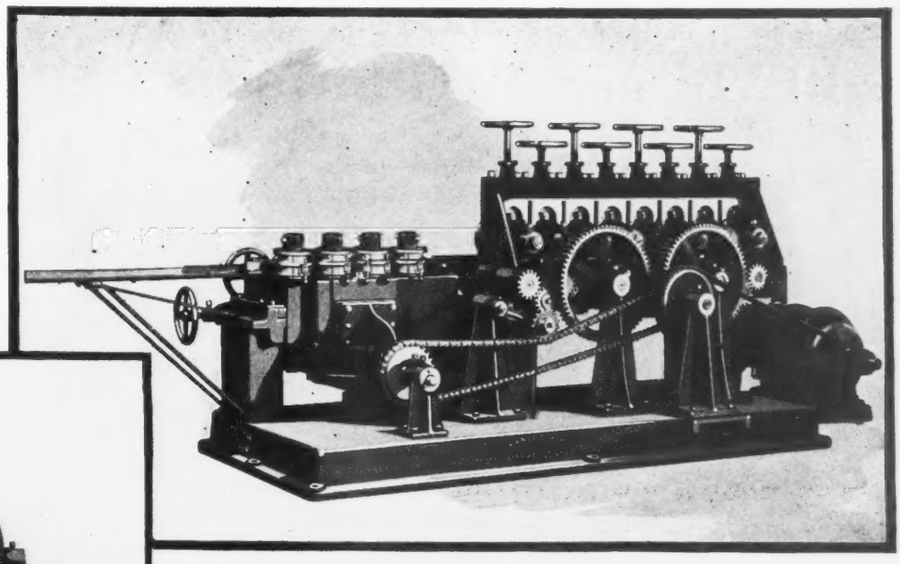
All Types of Gears, also

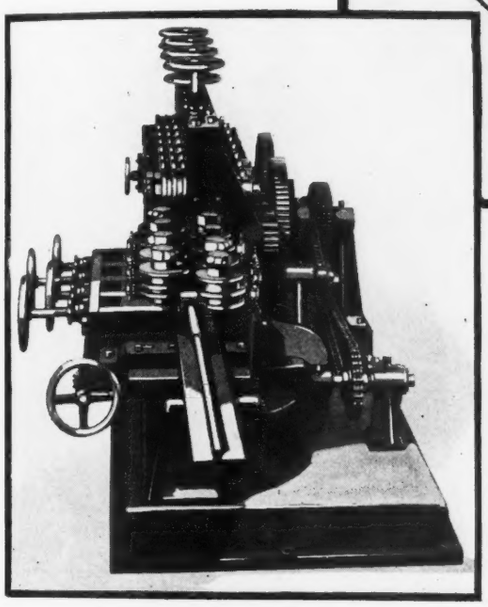
SKEW BEVEL GEARS

Special facilities for *straight* and *spiraloid* Bevel Gears

Member ACMA

The Bilgram Machine Works
1231 Spring Garden Street, Philadelphia, Pa.





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a prime essential in these GEARS

THE finished bars . . . products of these Roll Straighteners . . . must pass the most rigid tests. A variation, however slight, will disqualify them for use. Kane & Roach knew this when they equipped these Roll Straighteners with G & F gears. The accuracy of any machine depends on the accuracy and fit of its parts . . . that is one reason for their choice.

G & F standards hold strictly to specifications. Our engineers, schooled by long years of experience, may suggest desirable changes . . . but when once decided upon . . . the specifications are the law.

Our complete facilities for producing gears . . . we forge our own blanks and heat treat our own gears . . . put us in a position to handle your gear jobs.

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Drop, Flat Hammer and Upset Forgings
Cut Gears
Speed Reducers
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GEARS AND FORGINGS INC.
SPEED REDUCERS

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Spur, WORM
BEVEL *and* MITRE *Gears*

These are some of the types of gears you can get from Jones—cut or molded—in cast iron or steel. Also bakelite gears and rawhide pinions. Specialized equipment to give you specialized service. Our Gear Catalogue gives much practical gear information in conveniently usable form. We will gladly send you a copy.

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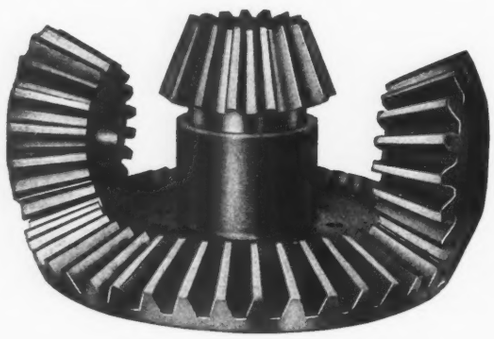
Branch Sales and Engineering Offices: New York, Cleveland, Milwaukee, Pittsburgh, Buffalo, Detroit, Birmingham, St. Louis, Cincinnati, Kansas City, Mo., Los Angeles, San Francisco.

Jones Industrial Gears

Spur Gear



Good Gears For Every Purpose

No matter what type of machine you make—what type of gears you require—how large or small the quantity—how soon you need them—you can do better with Cincinnati Gears. Irreproachable quality and accuracy, combined with quick delivery and moderate price, never fail to please a new user.

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1825-1841 Reading Road, CINCINNATI, OHIO

Immediate Delivery

Bond STANDARD stock gears

Methods that have been developed out of many years' experience in the manufacture of gears assure the utmost accuracy and even-running smoothness of Bond Standard Stock Gears.

The Gear sizes you require are carried in stock for immediate shipment at numerous distributing centers throughout the United States, which means that lost time is eliminated when you write, wire or 'phone your gear orders to Bond.

Send for Standard Stock Gear Catalog No. 54Y. It lists the largest stock of gear sizes available anywhere.

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CHARLES *Bond* COMPANY
Manufacturers
Gears—Leather Belting—Couplings

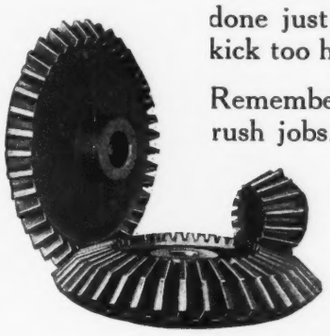
Use EARLE GEARS

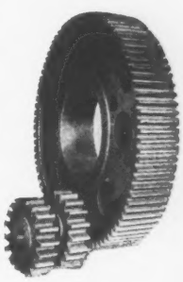
When a radio manufacturer has produced his 2,000,000th set, he has accomplished something of which to be justly proud.

If this radio manufacturer orders GEARS from EARLE (and he does), for replacement on his equipment ranging in size from huge presses to coil winding machines, he does so with the assurance that he will get good gears delivered to him in the shortest possible time at the lowest possible price.

You wouldn't like to commit the unpardonable sin of working the Fourth of July for a customer, would you? Well—we've done just that thing for Atwater Kent and would try not to kick too hard against doing its equivalent for you.

Remember—we specialize on "pleasing" on break down and rush jobs.





The Earle Gear & Machine Co.

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814 Farley Bldg., Birmingham, Ala.
117 King St., Melbourne, Australia
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P. O. Box 141, Plymouth, Pa.
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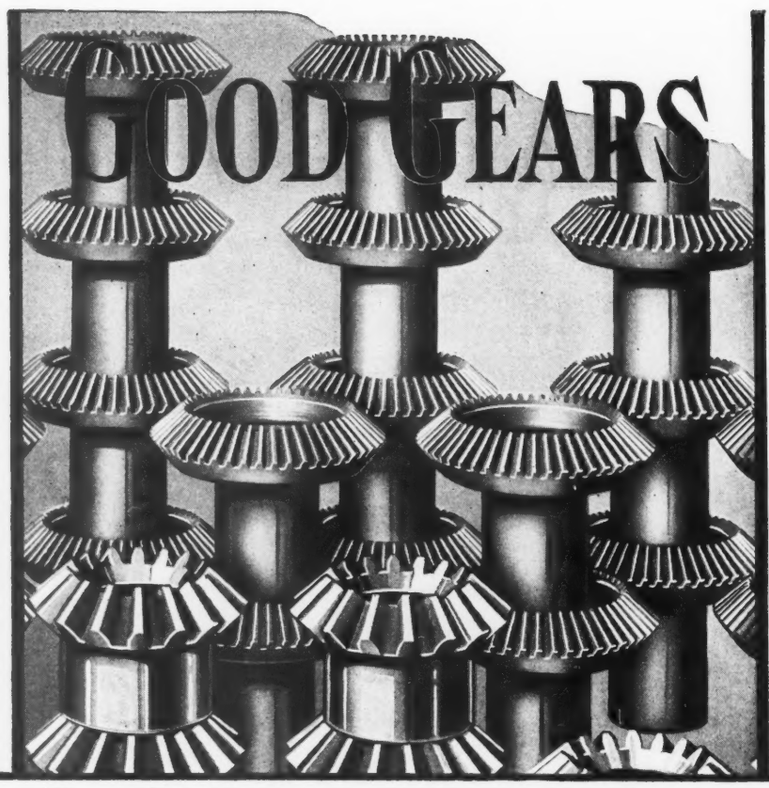
"We are also Manufacturers of Lea-Simplex COLD METAL SAWS and OPERATING MACHINERY for Movable Bridges, Locks, Gates, Dredges, Etc."



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that insure gear satisfaction!

Manufacturing experience, the use of quality material, production equipment for efficient service — if your gear manufacturer can assure you on these three important points he need go no further to guarantee your satisfaction in his gears and service.

The reputation of Hartford Gears is based on this firm foundation — an estimate and trial order will enable you to test it to your satisfaction.

HARTFORD GEARS

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Silence Pays!

The quiet machine will outsell the noisy one every time, and the surest way to quiet a machine is to silence its gearing.

Sier-Bath Gears are cut so accurately and so expertly that they reduce transmission hums to mere whispers. Smoother running, they wear less and last longer. Verily, silence is golden!

Estimates on receipt of prints

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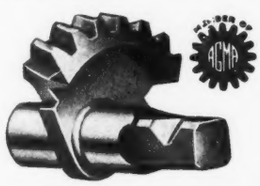
Meisel Gears are the kind that match the quality of your product in every respect. They are strong, durable, accurately cut and correct in mesh—guarantees of efficient power transmission under all conditions.

Moderately priced—promptly delivered; certainly worth a trial!



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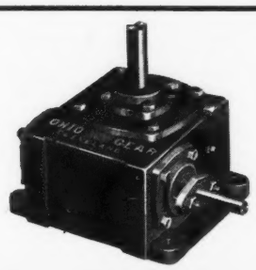
Meisel Press Mfg. Co., 948 Dorchester Ave. BOSTON 25, MASS.



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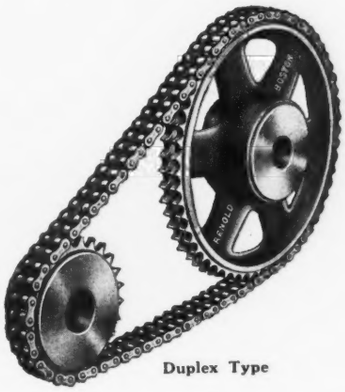
1/8 to 2 Horse Power

The Ohio Gear Company

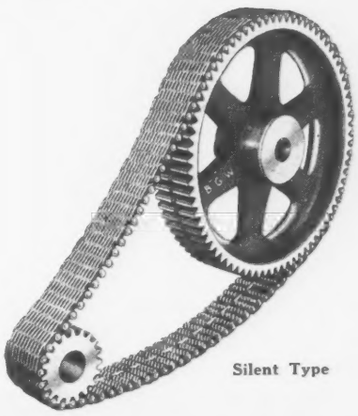
1333 East 179th Street **Cleveland, Ohio**

CHAIN DRIVES standardized and stocked for *immediate delivery!*



Duplex Type

Savings in power, light, space, first and maintenance costs are effected by Renold-Boston Chain Drives. Considerable saving in time is also possible by purchasing drives *from stock.* Any drive up to 100 H.P. shipped in *less time than it takes to obtain other quotations.*

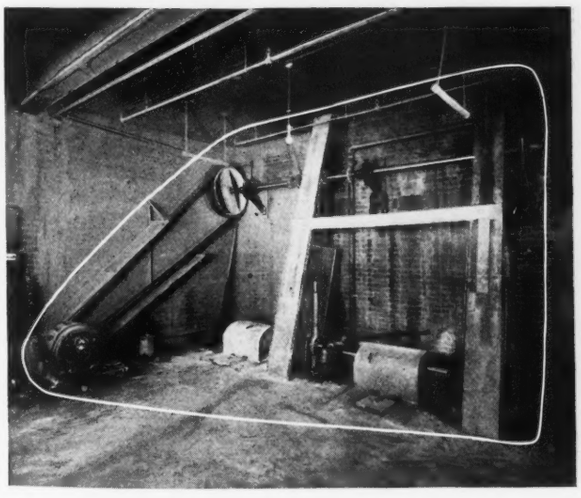


Silent Type

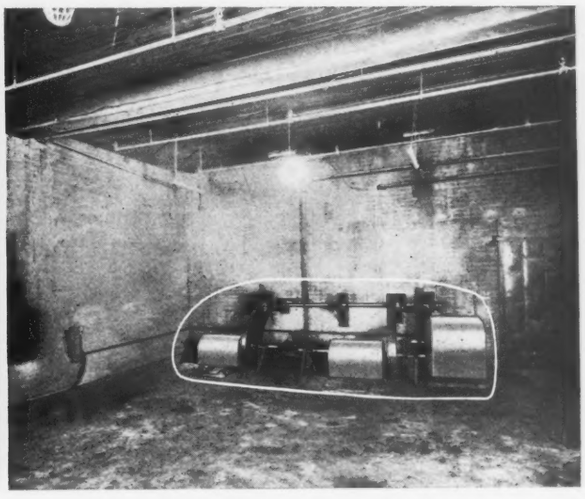
For immediate delivery in a wide variety of speed ratios for each horsepower:—

Roller and Silent types	up to 100 H.P.
Duplex Type	up to 50 H.P.
Compound Reduction drives	up to 20 H.P.

Larger drives to order promptly. Book "Renold-Boston Chain Drives" contains simplified selection charts, complete specifications and prices.



Old Time Belt Drive in Paint Factory, Operating Mixer.



Same Mixer Driven by R. B. Duplex Roller Chain Drive, 25 H. P. at 1150 R.P.M.

Boston Gear Works Sales Company, Norfolk Downs (Quincy), Mass.

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Made by Specialists in Gears and Service

In construction and design Stahl Gears answer your own description of perfect gears.

Cut by our exclusive process and hardened with greatest care, Stahl Gears last for years even on the most strenuous drives.

Scores of prominent manufacturers are acquainted with Stahl products and Stahl service. Write us for details and prices of this complete line.

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Estimates gladly furnished

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Let JANETTE Speed Reducers Simplify YOUR Machine Design Problems

JANETTE Motor-Driven Worm and Gear Speed Reducers combine a motor and speed reducer in one compact, sturdy assembly. Easily incorporated in the design of any motor-driven machine. Low cost. 1/30 to 1/3 H.P. Reductions of from 20 to 1 to 50 to 1.

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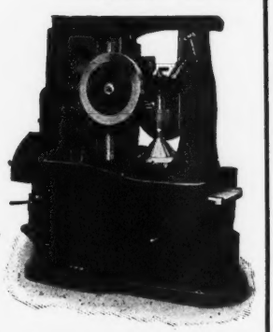

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RAWHIDE BAKELITE AND HARDENED STEEL PINIONS

Member American Gear Manufacturers Association

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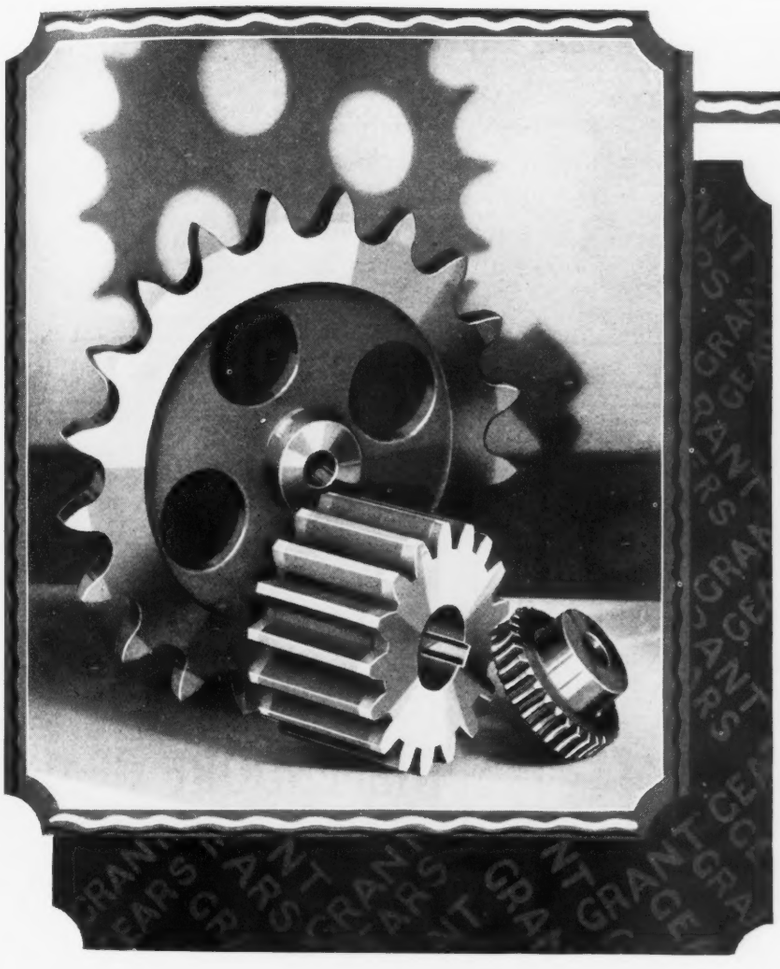

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ROLLER CHAIN DRIVES
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For more than fifty years, Grant Gear specialists have produced good gears. You will find this organization prepared at all times to meet your requirements in either standard or special cut gears. You will be satisfied with Grant service.

Gear advice cheerfully and promptly given. Grant 132-page catalog on gear wheels sent upon request.

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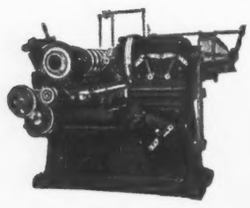
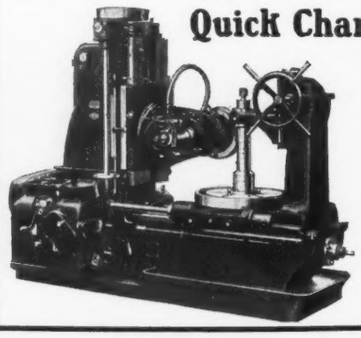
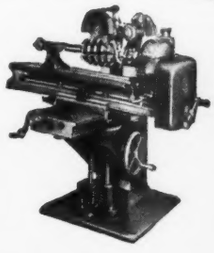


S & S SPECIAL WORM MILLER for heavy, smooth cuts. Quick change feed and speed boxes.

The New Type Schuchardt & Schutte Quick Change Gear Hobber



is setting entirely new standards of gear perfection through increased output combined with higher finish and accuracy.



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Exclusively
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Hob shown above is smallest size we make for arbor use. 120 pitch—¾" in diameter; we make smaller sizes than this in stem types.

Gear cutting Hobs are only one of our products. This one was made for machining rollers for platinum strip .007" thick for jewelry.

We are specialists in Small Hobs of every variety. If you have a problem let us help you. All standard and many special sizes of Small Hobs always in stock.

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ALL METALS
MICARTA, CELORON, FIBROC, RAWHIDE
Spur, Straight Bevel, Spiral Bevel, Helical, Internal

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Gears that Mesh with Profits

Hindley Worms and Worm Gears fit perfectly into the scheme of low costs and greater machine efficiency. Their special design provides for wider tooth faces, greater tooth contact—hence lower pressure per square inch of tooth contact.

This superior design, resulting in highly efficient power transmission and unusually long wear, is constantly increasing the list of Hindley users. Many of the country's most prominent manufacturers are already included. Try Hindley Gears—you'll find them all we claim—perhaps more. Write for details.

HINDLEY GEAR COMPANY
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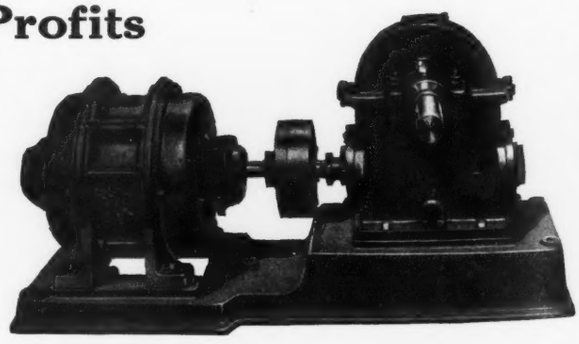
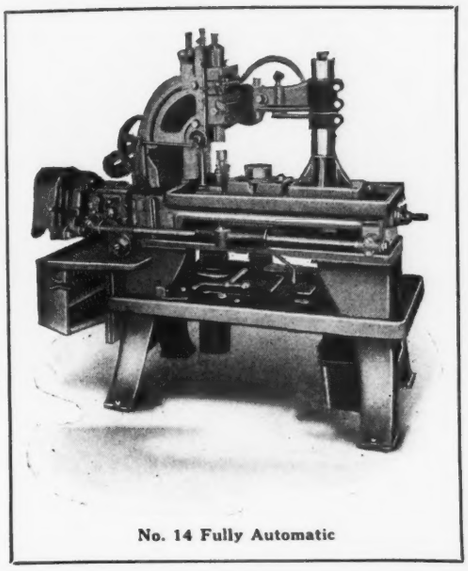


Hindley Speed Reducers are made in many sizes with Hindley Worms and Worm Gears. Efficient, dependable, lasting.

For cutting odd lots of diversified gears—Reduce your costs by using



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Whiton Fully Automatic Gear Cutting Machines

They are easy to set up and are especially well adapted to meet the requirements of shops which have to produce a wide variety of gears. These machines can also be used to advantage on production work.

The machine shown will cut spur, bevel and worm gears up to 32″ diameter.

Descriptive Literature on request

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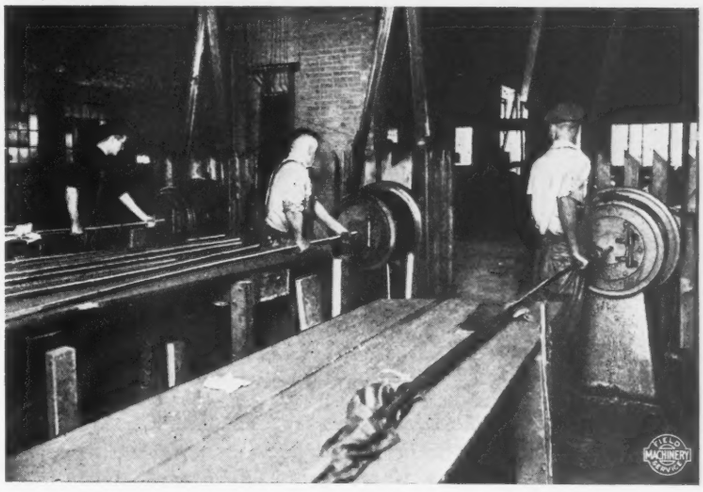
ETNA SWAGERS

Are Consistent Profit Makers



The Etna Swagers shown are three of a battery of five in the plant of a large Detroit automobile manufacturer. They are pointing tubing ranging in size from 1-1/6″ to 1¾″ in diameter before it passes through reduction dies.

Simplicity is the keynote of Etna design and operation — that's why this large Detroit automobile manufacturer found them so economical for reducing, pointing and tapering metal tubing and rods.

But Etna Swagers do *more* than the reduction work. The thousands of hammer-like blows these machines deliver actually strengthen the swaged portions by increasing the density and elasticity of the metal. Rugged construction and fine materials make Etna Swagers last unusually long and every operating hour is profitable. Write us for complete details.

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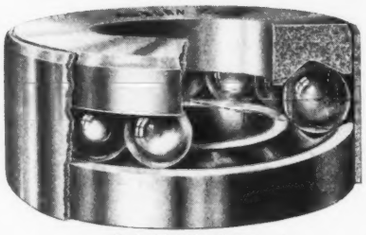
Maplewood Avenue and Castle Boulevard

"Like a Speedway"

Auburn Thrust Ball Bearings have angular (banked) surfaces in each race that facilitate circular travel, and maintain alignment of machine parts. There are many styles and sizes. Write for data sheets.



Style T-100 Thrust
STEEL, BRONZE, MONEL AND ALUMINUM BALLS

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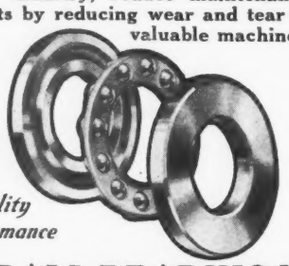
AETNA

THRUST BALL BEARINGS

Wherever there is sudden or constant thrust—friction's greedy jaws eat up profits. Aetna Thrust Ball Bearings, made by specialists, recommended by industry, reduce maintenance costs by reducing wear and tear on valuable machinery.



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HARTFORD "UNIVERSALLY DEPENDABLE" BALLS FOR BEARINGS

Made from High Carbon Chrome Alloy Steel
Carbon Steel Balls
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Ball and Roller Bearings, Diameters ½" to 30"
—one or a hundred thousand. Standard and Special Sizes.

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All Metal DD Silent Gears

Your next order for silent pinions should be for the

D D SILENT STEEL PINION

SPUR—BEVEL—MITER & WORM
GEARS and RACKS. CUT TEETH.

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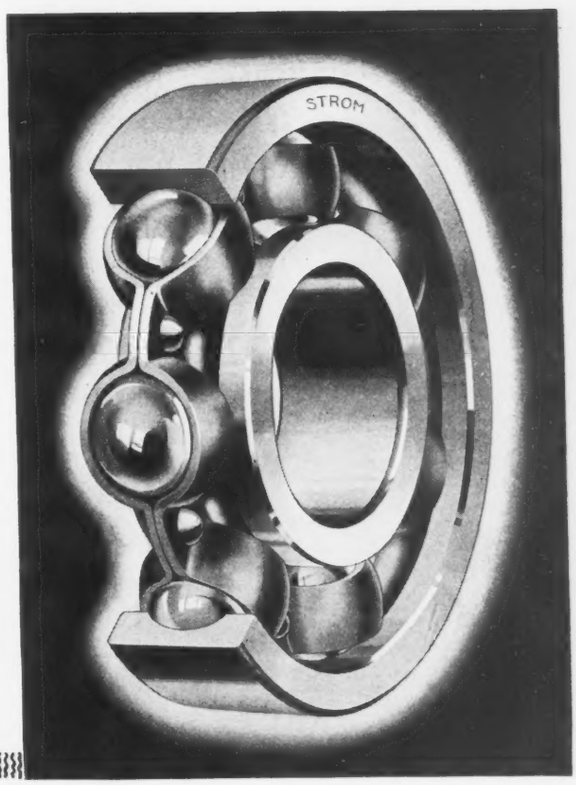
Continuous-Uninterrupted Operation . . . . . .

The Super-Strom Maintains Shaft Location Longer than Any Other Type of Bearing

PRODUCTION hold-ups to adjust or replace bearings are unnecessary in installations where the Super-Strom supports shafts or spindles. These high-quality Ball Bearings do not wear and never need adjustment. Continuous uninterrupted operation is assured.

The Super-Strom has many constructional advantages that distinguish it from other bearings. High carbon, Chrome Alloy Steel—a maximum number of Molybdenum steel balls—deep race grooves—retainers pressed from heavy gauge steel are features insuring a quality bearing of exceptionally high load-carrying capacity and longer life.



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Division of Marlin-Rockwell Corp.

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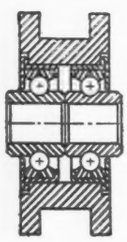
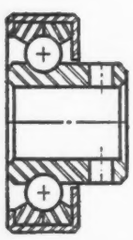
Strom BALL BEARINGS

Good Bearings *at the Right Price*





IN these days of intensive competition, reduction of costs is always of interest to the manufacturer. Not often are "low cost" and "quality" combined in one product. "Commercial" Annular Ball Bearings are an exception. These bearings are high-grade bearings, sold at a moderate price, due to enormous production and world-wide use.

"COMMERCIAL" bearings offer many distinct advantages. There is the famous three-point contact—an *exclusive* feature which provides longer wear and better service. There are more balls. There is also a combined radial and thrust load with thrust in *either* direction without adjustment of any kind, and—speeds up to 2500 R.P.M.

Here is everything you can ask in a bearing and the cost is no greater than you are asked to pay for inferior bearings. Let us tell you more about "Commercials," and let us also give you the benefit of our long experience in this field.

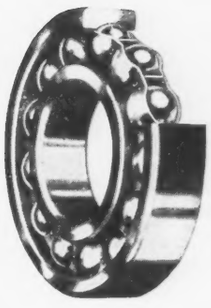
Send for Illustrated Catalog, Discount Sheets and Samples

THE SCHATZ MANUFACTURING COMPANY

POUGHKEEPSIE, NEW YORK

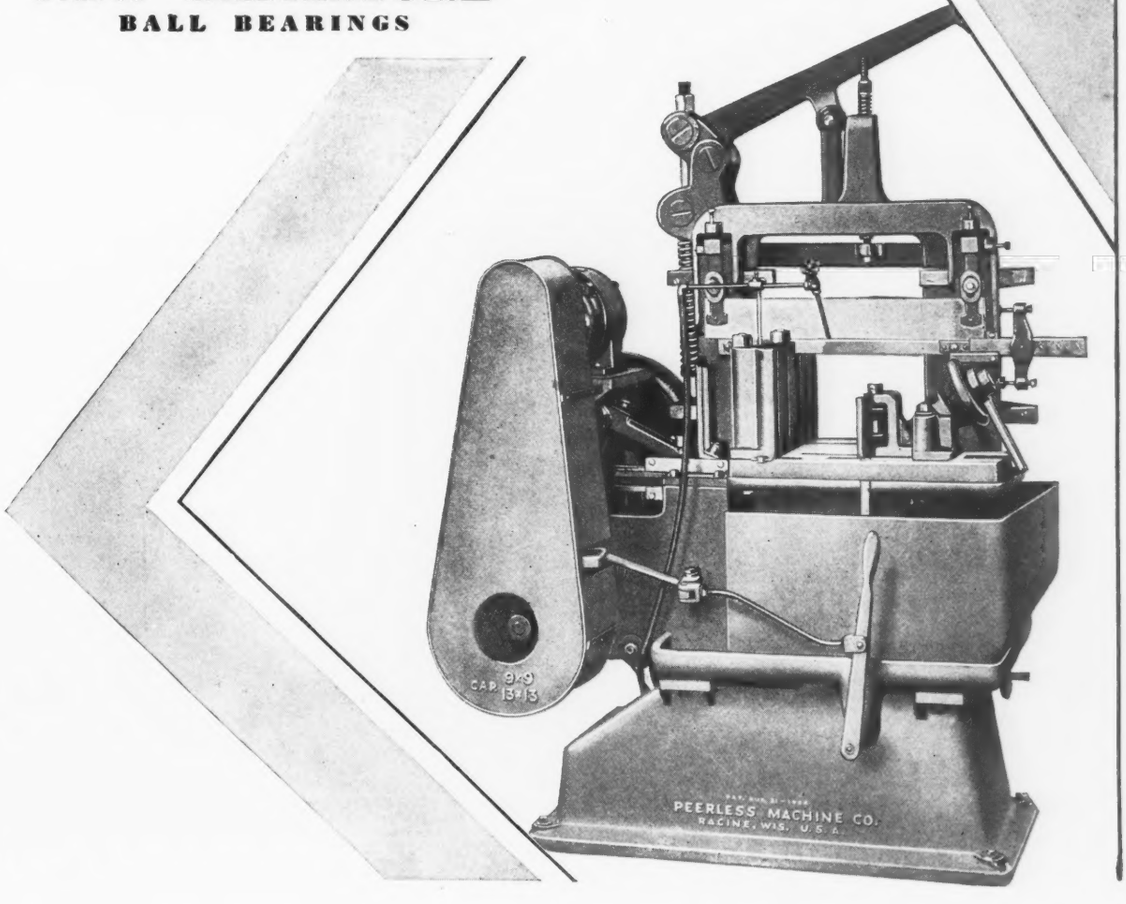
"Commercial"

Better bearings cost the user less



REALIZING that a machine can be no more free from attention than are its bearings, the Peerless Machine Company was careful to select New Departures for its Universal Type Metal Cutting Saw. ✓ ✓ Designers, builders and users have found them supreme for giving rigidity to spindles, quietness to gear boxes, and free-running smoothness to lead screws and controls. Readjustments are never necessary; lubrication and upkeep expense practically nil. ✓ ✓ When a machine is worn out, its original New Departures often show no signs of wear. ✓ ✓ The New Departure Manufacturing Company, Bristol, Connecticut; Detroit, Chicago and San Francisco.

NEW DEPARTURE
BALL BEARINGS



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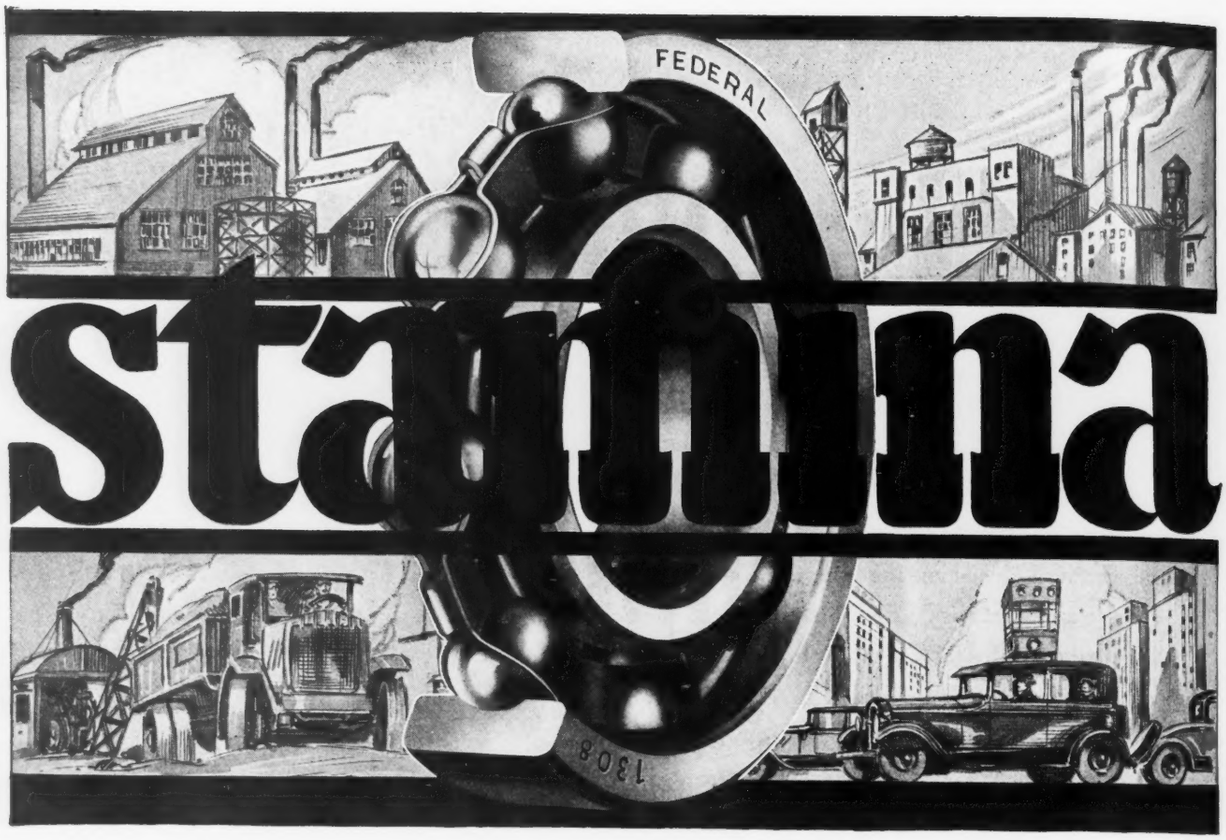


stamina

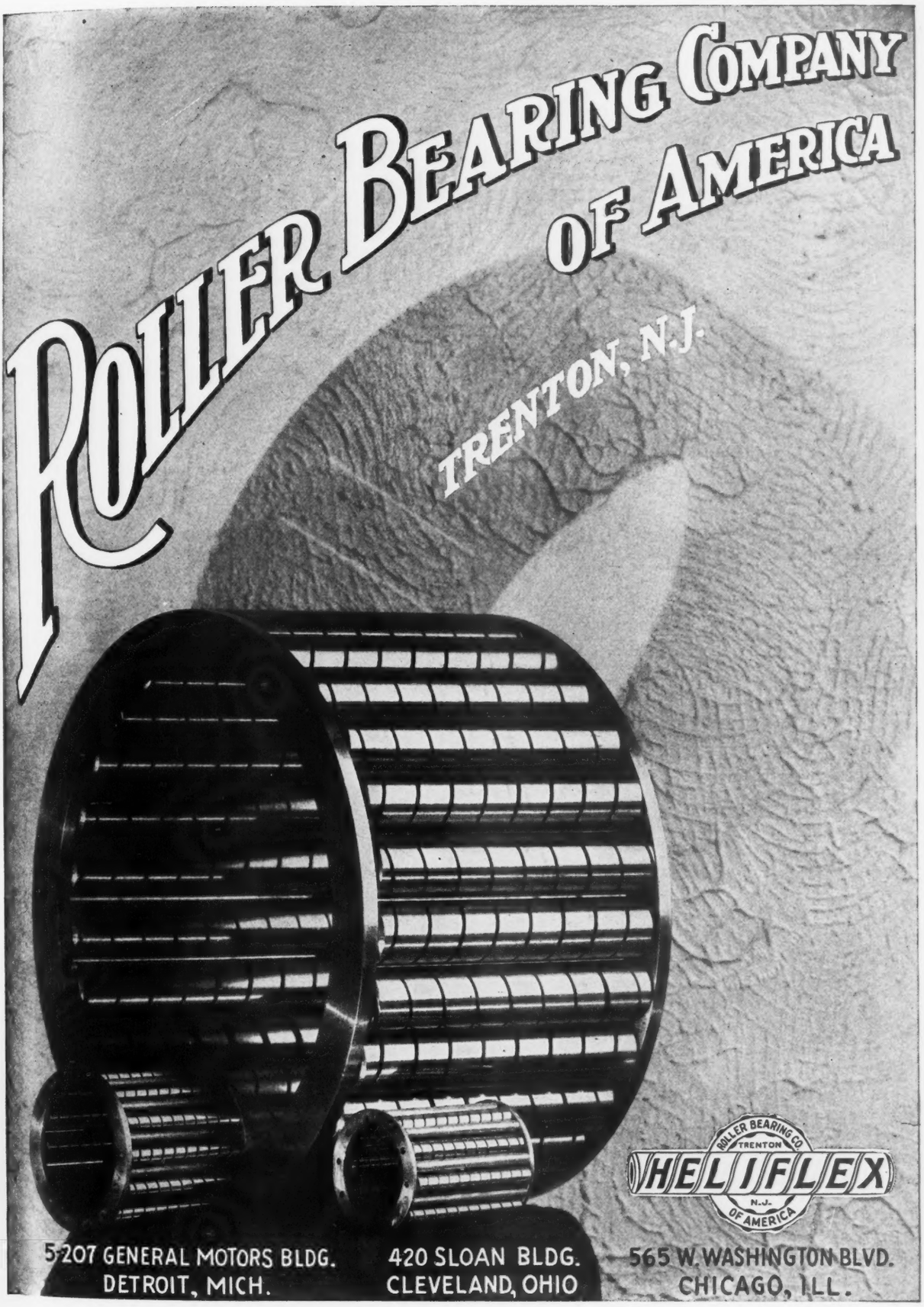
MADE OF THE FINEST high carbon chrome alloy steels, Federal Radial Ball Bearings possess unusual *stamina.* Long life and dependable wear are characteristics of these bearings—characteristics which mean economy and absence of trouble. Consequently, the performance of "Federals" is just as pronounced as their quality. That is why manufacturers select Federal Radial Ball Bearings in preference to ordinary bearings.

We shall be pleased to forward samples, quotations and complete information to those interested.

The FEDERAL BEARINGS CO., *Inc.* POUGHKEEPSIE, N.Y. Detroit Office: 917 Book Building

FEDERAL

RADIAL BALL BEARINGS


ROLLER BEARING COMPANY OF AMERICA
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ROLLER BEARING CO. TRENTON N.J. OF AMERICA
HELIFLEX
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METAL structure is the most important factor, if the bearings are to hold the smooth surface over a long period.

Non-Gran Bronze is made of virgin metals, by a highly *specialized* process that develops and holds a smooth, almost frictionless bearing surface and cannot flake-off, owing to the closely interwoven interlocking *fibrous* structure.

Solid or cored bars, ¾″ to 5″ o.d., in 1- and 2-foot lengths.

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Immediate deliveries on finished bushings and bronze bars published in the "Service Stock List"—send for it.

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QUALITY IS MAKING US FAMOUS

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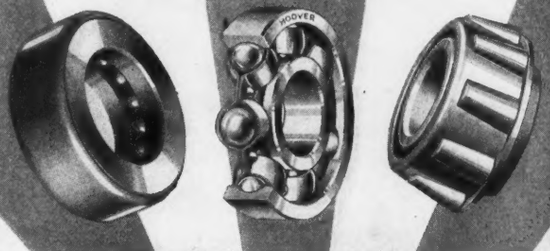

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Balls.
Ball Bearings (annular and thrust).
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Let us figure with you.
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Branches: Chicago, Brooklyn, N. Y., San Francisco

You Pay Nothing For This Experience

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You do not need to pay anything for Bushing Bearing experience. Here exists a vast fund of metallurgical and technical knowledge developed at our own expense in years of research, production and observation. It is offered to you freely.

Leading machinery manufacturers in all industries have obtained here, and without cost, the answer to bearing problems which they had previously sought in vain and at great expense. You are in no way obligated by consulting us.

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Patterns and Tool Equipment for over 20,000 different designs.

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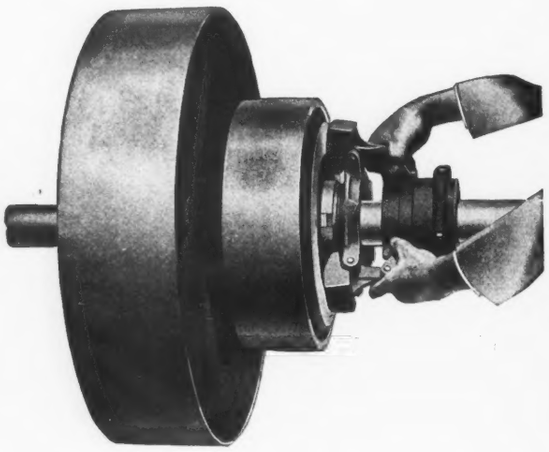
A Real Good Friction Clutch



The Peerless *It's Unit-Adjusting*

The peerless Unit-Adjusting Clutch is powerful yet compact; has few parts, all interchangeable; and all adjustment for wear is made at one point.

Adjustment is so simple that it can be made by anyone without the use of any special tools. Simply loosen the small hollow set-screws in adjusting nut and with clutch thrown out of engagement turn the toggle mechanism with your two hands—see illustration above; turning to the right to tighten the clutch and to the left to loosen it.

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Makers of Shafting, Hangers, Collars, Pulleys, Friction Clutches, Ball Bearings, Flexible Couplings, Rope Sheaves, Pillow Blocks, the U. G. Automatic Belt Contactor, Grooved Pulleys for "V" Belts and Complete "V" Belt Drives.

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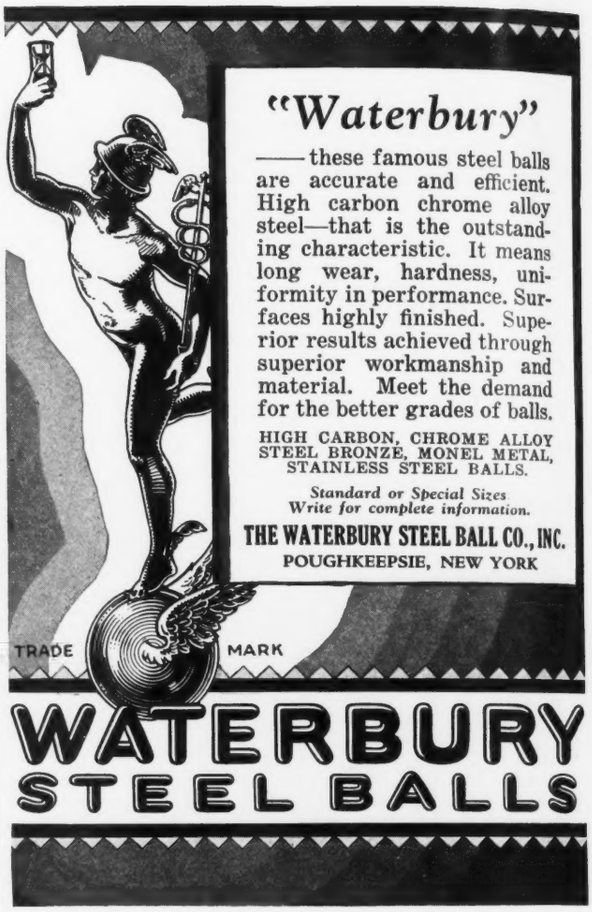
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—— these famous steel balls are accurate and efficient. High carbon chrome alloy steel—that is the outstanding characteristic. It means long wear, hardness, uniformity in performance. Surfaces highly finished. Superior results achieved through superior workmanship and material. Meet the demand for the better grades of balls.
HIGH CARBON, CHROME ALLOY STEEL BRONZE, MONEL METAL, STAINLESS STEEL BALLS.
Standard or Special Sizes
Write for complete information.
THE WATERBURY STEEL BALL CO., INC.
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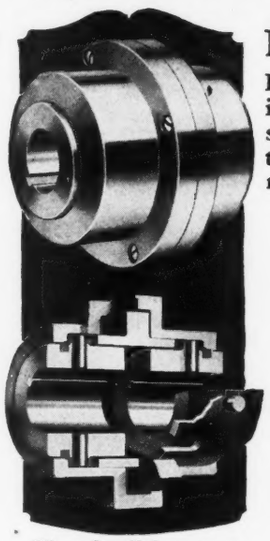
STEEL BALLS

The New FLEX-RING!

A Full-Floating All-Metal

Flexible Coupling



Fully enclosed, approaching a universal joint in design and quiet in operation. The ONLY coupling now manufactured that:

1—Allows for *excessive* misalignment of shafts.
2—Allows for *excessive* offset between shafts.
3—Permits end-play with minimum resistance.
4—Absorbs shocks and vibrations in the drive.

Without Increasing Bearing Loads.

FLEX-RING COUPLING

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F-4

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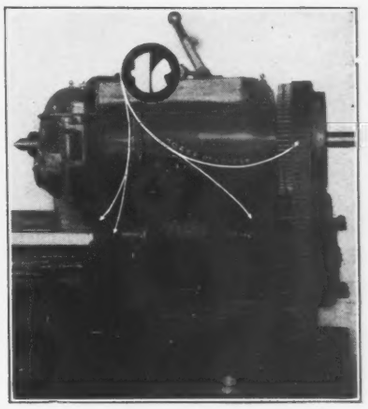
Maintenance Costs Are Less With MORSE CHAIN DRIVES

IN these days of strenuous competition, every manufacturer needs to watch overhead expense. A big item in this bill that all industry must pay is that of power loss—waste through inefficient transmission of power, or heavy expense in maintaining present forms.

Morse Silent Chains cut these losses. They are easy to install and maintain, they do away with complicated and expensive arrangements of belts, shafts, and gears. They increase production by maintaining a positive speed on the driven shaft, at the same time they have the flexibility of a belt. They are compact, conserving valuable floor space for useful production, and they save wear on expensive machines due to shock loads in starting and stopping. And over long periods of time, they deliver 98.6% of power generated to the point of use.

The full story of Morse Chain Drives, and the economies that they will effect in your industry is ready for you. It will be sent to you on request, without obligation. In addition, a Morse engineer will be glad to confer with you at your plant on power transmission problems. Write for the data file, the engineer—or both.



Morse equipped Monarch lathe in plant of Cadillac Motor Car Co. Morse Silent Chains are standard equipment on Monarch Lathes.

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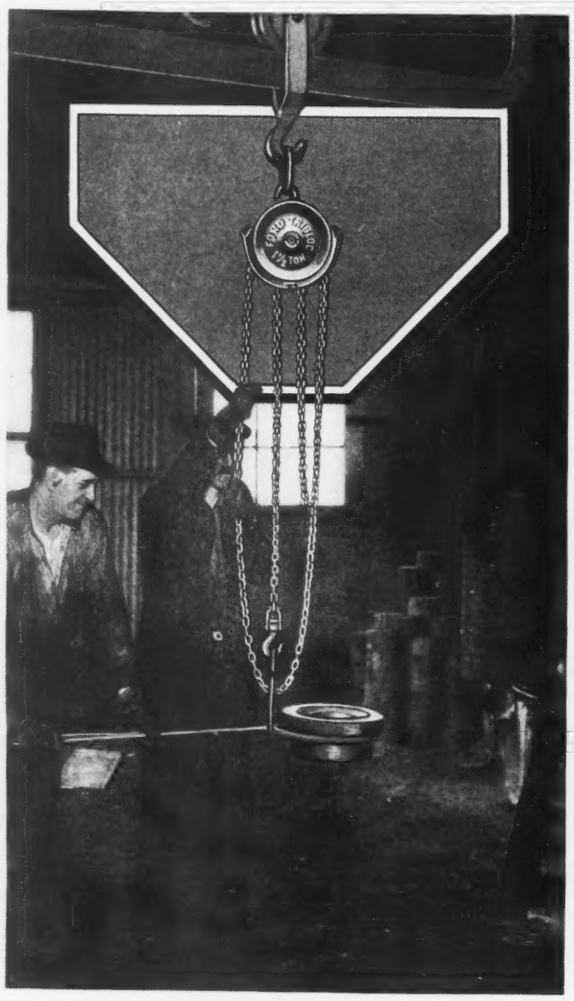
MORSE SILENT CHAIN DRIVES

←55→

FORD TRIBLOCS



A Ford Tribloc is used here for the handling of hot dies - work demanding an absolutely safe, smooth operating hoist. Ford Triblocs are daily becoming more and more popular in plants where delicate lifting problems must be solved.

Ford Triblocs are available in all sizes from 1/4 to 40 tons, with a complete line of roller bearing trolleys, both standard and low head room types.

FORD CHAIN BLOCK CO., PHILA., PA.

SPEED UP PRODUCTION!

SEND FOR BOOKLET

By installing Renold-Boston Stock Drives. They transmit power smoothly and easily at high speeds, and enable you to improve and increase production. Use all the power you pay for by installing Renold-Boston Stock Drives. Install a trial drive—it will soon return its cost.

RENOLD-BOSTON
STANDARD STOCK DRIVES
24 HOUR SHIPMENT
Any Drive from 1 to 100 H.P.
HANS RENOLD INC. 200 HUDSON ST., NEW YORK
or any
Boston Gear Works Sales Co. Branch

Peerless *Hoist*

Hoist Gear Construction that Lasts

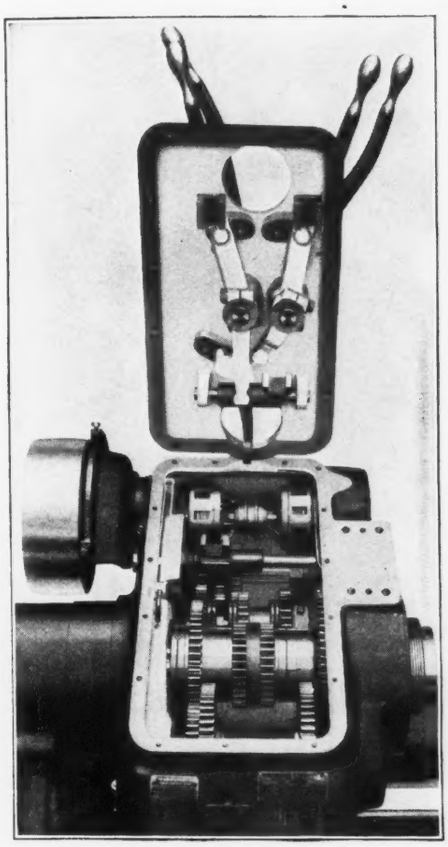
NOTE:

Harrington hand chain hoists come in six types up to 20 tons capacity. There is a Harrington electric hoist for routine ½ and 1-ton lifts.

The Gear construction in Harrington Peerless Hoists is the same as in automobile transmissions—of alloy, heat-treated steel. Not a single gear has been returned broken or worn during the years these gears have been used in the hoists. Gears will be the last part of a Harrington hoist to wear out . . . Only *one* feature of Harrington all-steel hoist design. Write for literature.

THE HARRINGTON COMPANY
PHILADELPHIA

Built for Performance



AS developed for use in machine tools, the Twin Disc Clutch, in both oil-sprayed and dry plate types, is built to precision standards equal to those of any other part of the machine.

S. A. E. tolerances and 100 per cent inspection of materials and workmanship assure to users:

1. A permanent quality of smooth engagement.
2. Positive load carrying action to full capacity.
3. Ease of maintenance in perfect adjustment.
4. Complete interchangeability of parts.
5. Assurance of long, useful life.

Machine tool manufacturers can depend upon uniform high quality in every size and both types of Twin Disc Clutches. Write.

♦♦♦

This Company now manufactures two types of clutches in sizes suitable for use in machine tools. One is a multiple plate clutch operating in oil. The other is a dry plate clutch with either single or multiple driving plates. Both types possess, to a high degree, the Twin Disc features of smooth engagement, ease of adjustment, dependability, long life and adaptability to engineering conditions. A large number of prominent machine tool manufacturers have adopted Twin Disc clutches as standard equipment.

PARTS STATIONS

Boston, Mass.—Rapp-Huckins Co. Inc., 59 Haverhill St.
Buffalo, N. Y.—Edward W. Rode, 45 A. St.
Cleveland—Industrial Engine Parts, Inc., 1053 E. 61st St.
Chicago—Motive Parts Co. of America, Inc., 2419 Indiana Ave.
Des Moines—Motive Parts Co. of America, Inc., 1204 W. Grand Ave.
Detroit—Whitney Brothers, 6464 Epworth Blvd.
Fort Worth, Tex.—Fort Worth Wheel & Rim Co., 312 Throckmorton St.
Houston, Tex.—Portable Rig Co., Inc.
Los Angeles—Coast Machinery Corporation, 406 E. Third St.
New York City—John Reiner & Company, Inc., 309 Church St.
Philadelphia, Pa.—Maerky Machine Works, 240 Cherry St.
Pittsburgh, Pa.—Motive Parts Co. of Pa., 6314 Penn. Ave.
Raleigh N. C.—Motor & Equipment Co., 215 E. Davie St.
San Francisco—F. Somers Peterson Co., 57 California St.
Tulsa, Okla.—Buda Engine Service Co. of Tulsa, Inc.

TWIN DISC CLUTCHES

TWIN DISC CLUTCH COMPANY

RACINE WISCONSIN

Take the Hub For Example

Any trained eye can see why "Americans" are superior. The reasons are built in everywhere throughout their scientifically designed pressed steel construction.

Notice the hub, for example. A pulley is a continuous lever. The hub must resist the multiplied strains applied at the rim.

That is why the hub of the "American" Pulley is a brute for strength . . . why powerful bolts clamp it to the shaft so securely that generally, no keys are necessary . . . why it is complete in itself, with or without a bushing . . . a solid foundation upon which to build superior pulley service.

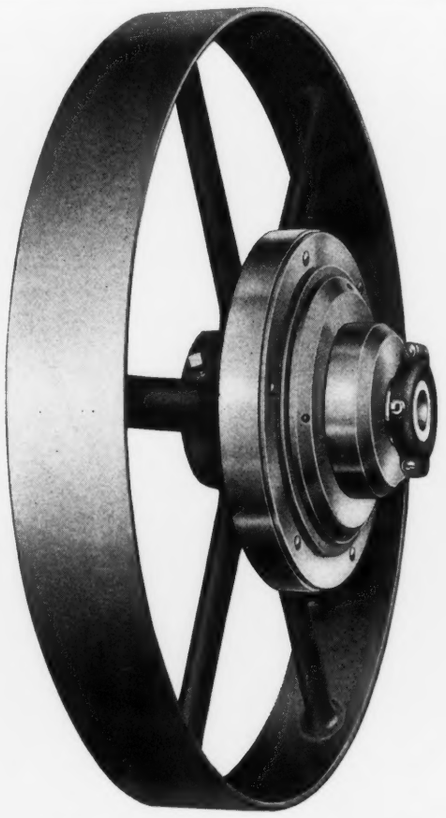
THE AMERICAN PULLEY COMPANY

Pressed Steel: Pulleys Hangers
Hand Trucks Miscellaneous Stampings

4200 Wissahickon Ave., Philadelphia

For nearest distributor see MacRae's Blue Book

AMERICAN
PRESSED STEEL HANGERS PATENTED
STEEL SPLIT PULLEYS PATENTED



Do Conway Clutches Increase Production?

Listen to This!

On a machine tool built expressly to machine valve castings, production was fifty (50) per day. The factory superintendent was satisfied with the production, but he was on the other hand, thoroughly disgusted with the "bang it in" and "drag it out" make and break of the clutch controlling the drive.

So—the clutch was replaced with a Conway Disc Clutch Pulley.

Production increased from fifty (50) to seventy-nine (79) pieces per day, and all the other machine operators in that department are clamoring for Conway Disc Clutch drives.

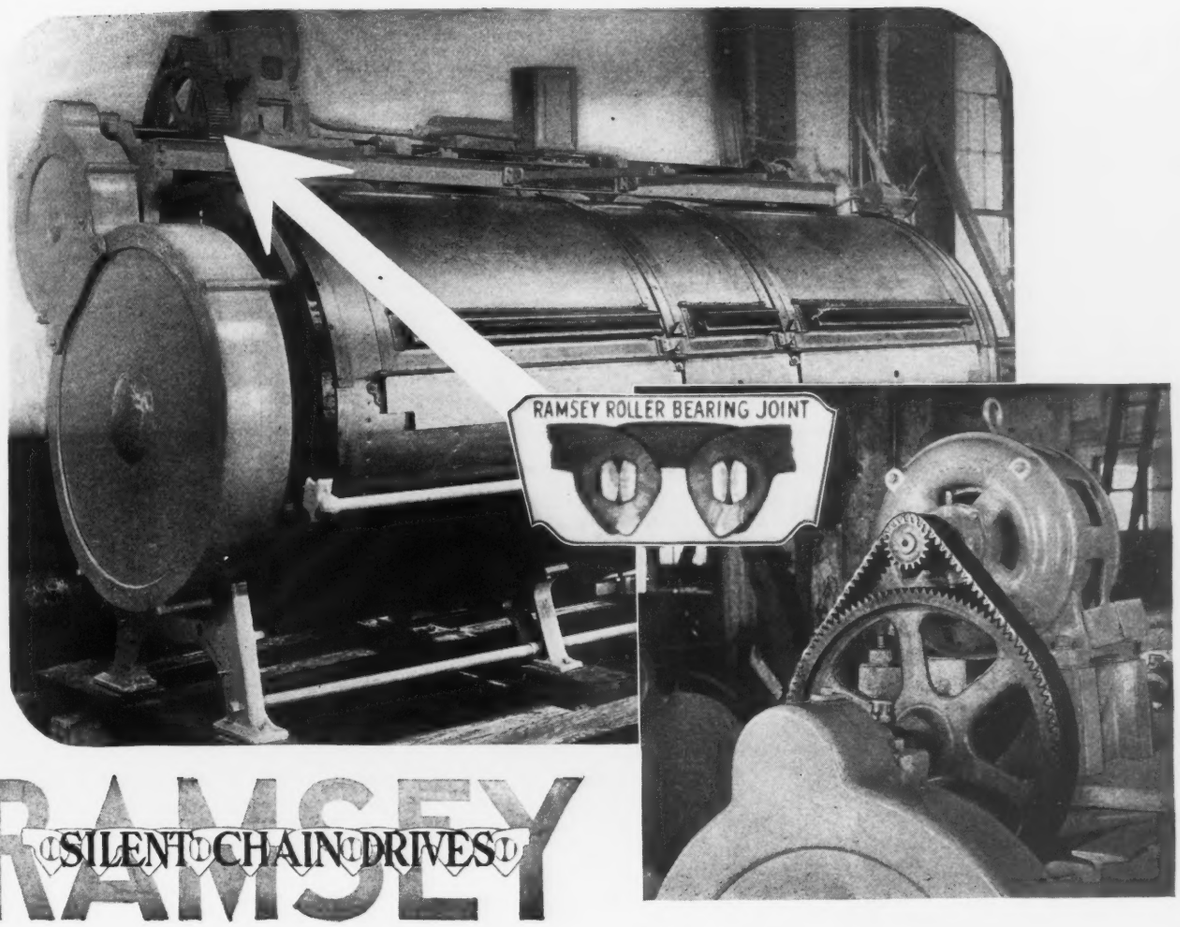
Easy engagement, instant release, dragfree idling, power capacity and centripetal action, — coordinated excellently into splendid start, go and stop—that enhances operator morale—which in turn increases production.

But there is more to the Conway Disc clutch than this. Get out our bulletin DC and take a look at the last word in friction clutches.

The Conway Clutch Co.

1962 W. 6th Street, CINCINNATI, OHIO

"The Conway Clutch is a splendid Clutch"



RAMSEY
SILENT CHAIN DRIVES

Symmetrical Design a Feature in Operating Efficiency

The links and pins of Ramsey Silent Chain are symmetrical; the chain operates with equal efficiency in both directions—a particular advantage in the case of a reverse drive of the type shown here.

Ramsey Silent Chain Drives are used on these dual washers because they give perfect satisfaction on the short centers although reversing under full load from 7 to 11 times a minute.

The **New Ramsey Catalog** gives interesting details on a variety of installations—may we send it?

Improving Power Transmission

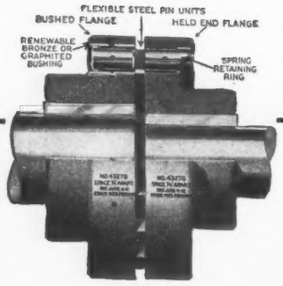
Why Ramsey Silent Chain is Preferred

Accuracy
Quiet Operation
Symmetry

RAMSEY CHAIN COMPANY, Inc.
1039 BROADWAY ALBANY, N. Y.

BRANCH OFFICES AND AGENTS

Atlanta, Ga., Ramsey Chain Company, Inc., (Branch Office and Warehouse).
Baltimore, Md., L. A. Benson & Co.
Birmingham, Ala., Young & Vann Supply Co.
Boston, Mass., Ramsey Chain Company, Inc., and Union Gear & Machine Co.
Chicago, Ill., Ramsey Chain Company, Inc.
Cleveland, Ohio, Ramsey Chain Company, Inc., (Branch Office and Warehouse).
Columbus, Ohio, Osborne & Sexton Machinery Co.
Denver, Colo., E. C. Horne Machinery Co.
Detroit, Mich., Ramsey Chain Co., Inc., (Branch Office and Warehouse) and Palmer-Bee Company.
Gastonia, N. C., Ferguson Gear Co.
Kansas City, Mo., Morse Engr. Co.
Los Angeles, Cal., F. C. Millard Engr. Co.
Newark, N. J., Ramsey Chain Company, Inc.
New Orleans, La., Standard Supply & Hdwre. Co.
New York, N. Y., Ramsey Chain Company, Inc.
Philadelphia, Pa., Ramsey Chain Company, Inc., and Robert L. Latimer Co.
Pittsburgh, Pa., Starr Equipment Co.
Rochester, N. Y., Erskine-Healy, Inc.
St. Louis, Mo., Morse Engr. Co.
Salt Lake City, Utah, National Equipment Co.
San Francisco, Cal., Ramsey Chain Company, Inc., (Branch Office and Warsehouse) and Pacific Gear & Tool Works.
Utica, N. Y., Langdon & Hughes Construction Co.
Canadian Factory: Hamilton Gear & Machine Co., Toronto.



Note especially the improved construction of this bushed, laminated-pin type. Easy to install, satisfactory service and lower maintenance because all-metal and no movement or wear on shaft flanges.

For direct-connected and geared motor, turbine, engine drives

You will find them today improving the operation of machines everywhere, as more than 76,000 FRANCKE couplings have been installed since 1912.

Special features worth your careful attention include: Spring cushion for load shocks and vibration. Provision for handling all accidental shaft misalignments. More and easier endwise movement. Self lubrication for most usual drives. Easy to line up, disconnect or assemble. Greater bore and power capacity, resulting in lower cost per unit.

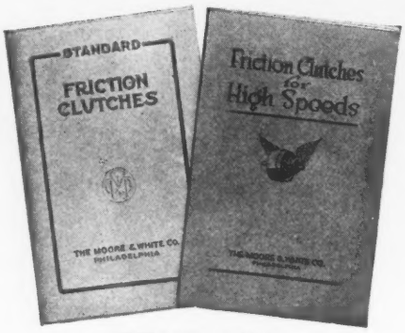
Stock sizes up to 500-750 H.P., larger sizes up to 5000 H.P. built to order.

Send for new Catalog No. 40.

FRANCKE
FLEXIBLE COUPLINGS

SMITH & SERRELL, 62 Washington St., Newark, N.J.

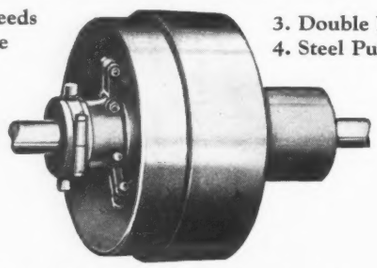
MOORE & WHITE FRICTION CLUTCHES



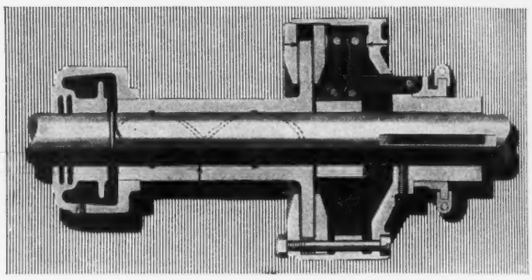
SEND FOR
Friction Clutch Catalogs

Any or All of the Following Sent Free on Request.

1. High Speeds
2. Moderate Speeds
3. Double Discs
4. Steel Pulleys



THE MOORE & WHITE CO.
2707 No. 15th St., PHILADELPHIA, PA.
"Friction Clutch Manufacturers for 44 Years"



BROWN CLUTCHES

Automatically Self-Lubricating

Sleeve bearing, shift collar—every moving part in a Brown Mule-Pull Clutch is positively, automatically self-lubricating. There is no chance for undue wear.

Common faults of clutch construction and design have been eliminated, and Brown Clutches provide a positive control which eliminates lost motion and prevents the shocks and jars so destructive to your costly machines. A substantial reduction in power costs usually follows Brown installations. Send for Bulletin 25.

Brown
Mule-Pull Products

BROWN ENGINEERING COMPANY
133 North 3rd Street
READING, PA.

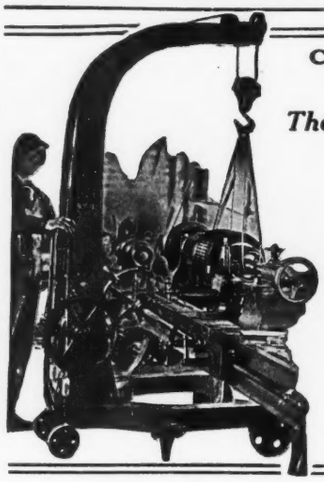
Hanna Hoists

Will Do The Job For Less

Catalogue No. 15 Gives Many Illustrations.

May We Send It?

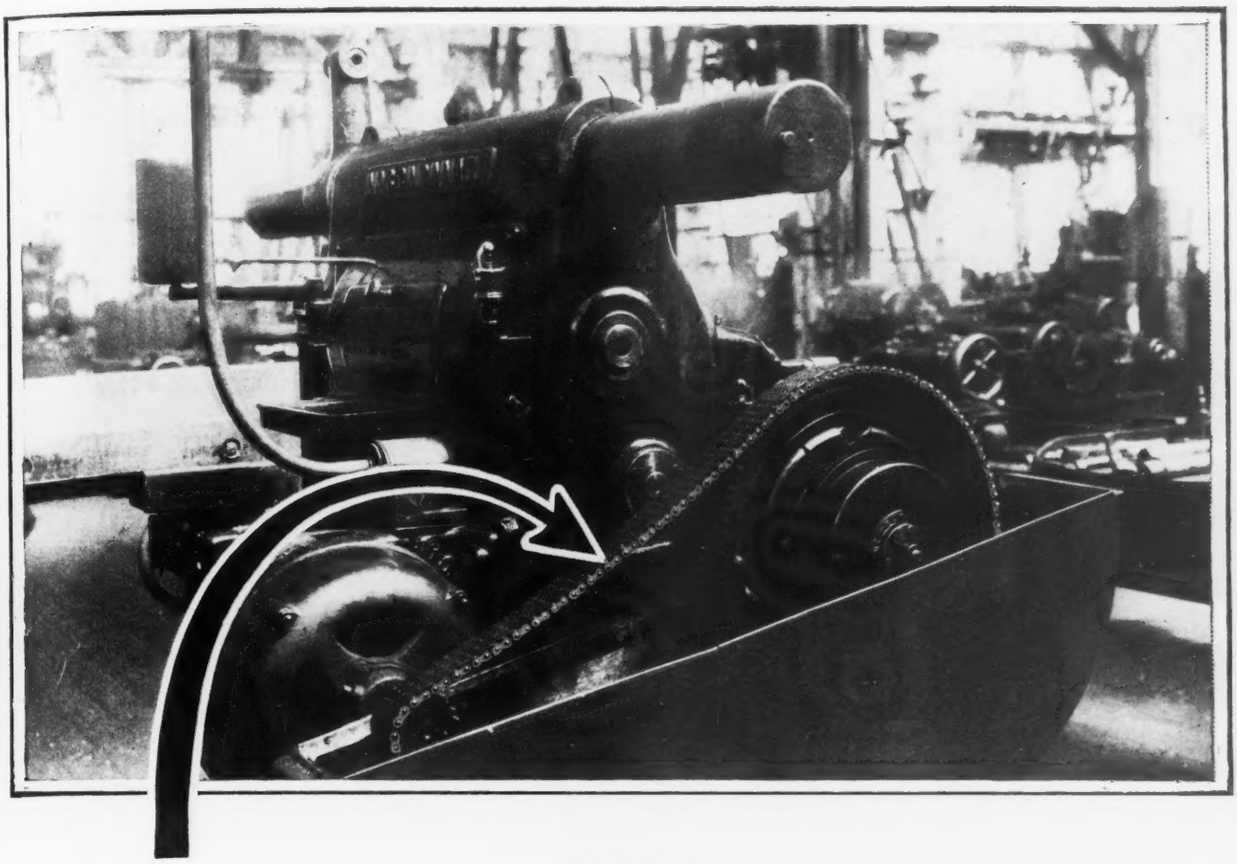
Hanna Engineering Works
1763 Elston Avenue CHICAGO, ILL.



CANTON PORTABLE
Floor Cranes
The Biggest Time Savers in Your Shop

Provide for movement of small loads without bringing the big overhead crane into action. With a Canton Portable, loads up to 6000 lbs. can be quickly and easily handled. Friction Load Brake holds load wherever it is placed—prevents accidents. Low base will slip under almost any machine. A Canton pays for itself in no time. Send for details.

CANTON FOUNDRY & MACHINE CO.
CANTON, OHIO
New York Office: 101 W. 31st St.



WHITNEY
Silent
Chain Drive on
No. 3 Cincinnati
Miller

MORE power for heavy cuts — freedom from delays due to belt troubles — more flexible speed control — wider choice of location —every shop man knows the advantages that come from substituting individual motors and WHITNEY Silent Chain for belt drives on machine tools.

If you are buying new machines, the manufacturer will be glad to equip them for WHITNEY Silent Chain Drive; and when it is a question of changing over belt-driven machines already in use, WHITNEY engineers are at your service.

THE WHITNEY MFG. CO., Hartford, Conn.

SALES AND ENGINEERING OFFICES

NEW YORK
L. C. Biglow & Co., Inc.
250 W. 54th St.

BOSTON
The Whitney Mfg. Co.
250 Stuart St.

PHILADELPHIA
The Whitney Mfg. Co.
133 So. 36th St.
Philadelphia Gear Works
Erie Ave. and G St.

SYRACUSE
George McPherson
201 Norwood Ave.

CHICAGO
The Whitney Mfg. Co.
549 W. Washington Blvd.

PITTSBURGH
Pittsburgh
Gear & Mach. Co.
27th & Smallman Sts.

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Smith Power
Transmission Co.
1213 W. Third St.

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The Whitney Mfg. Co.
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General Motors Bldg.

SAN FRANCISCO
A. H. Coates Co.
615 Howard St.

SEATTLE
A. H. Coates Co.
1743 First Ave. So.

LOS ANGELES
L. A. Automotive Works
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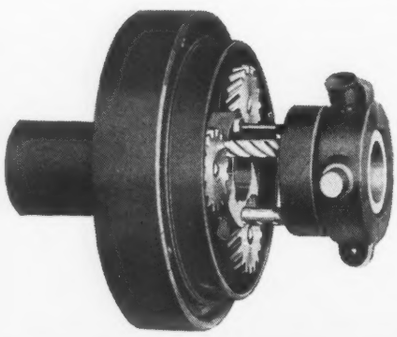
PORTLAND, ORE.
Portland Iron Works
495 Northrup St.

WHITNEY SILENT CHAIN DRIVES

What Other Clutch Maker Can Offer More Than—?



—a flexible design of proven merit, adaptable to all requirements, that assures a minimum of working parts and a minimum of trouble.

—the best clutch for the money, whether low priced for short-lived equipment, or the finest obtainable for delicate high precision equipment.

—an engineering staff, backed by 20 years' experience, to work with you *without charge* in designing your clutch.

—custom-made quality at ready-made prices.

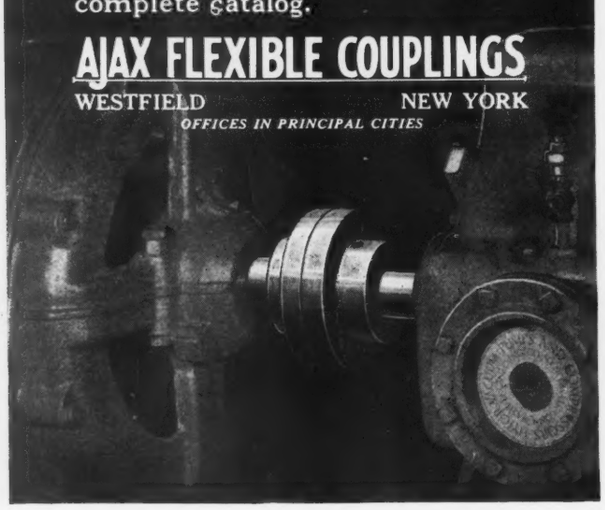
Estimates gladly submitted

THE HILLIARD CORPORATION
ELMIRA, N.Y.

Uses Ajax Couplings

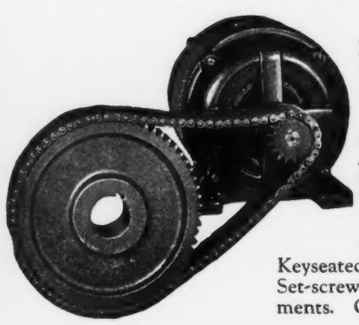
Most manufacturers of quality machinery have standardized on the Ajax Type "A"—Foote Bros., D. O. James, Lamson, Taber, Nash, Phillie Gear, Link-Belt, Brownhoist, Dings and many others have tested and accepted Ajax Flexible Couplings. Write for complete catalog.

AJAX FLEXIBLE COUPLINGS
WESTFIELD NEW YORK
OFFICES IN PRINCIPAL CITIES



CULLMAN SPROCKETS

for
Electric Motor Drives
½ H. P. to 10 H. P.
Reduction Ratio
1-1 to 7-1 in Stock



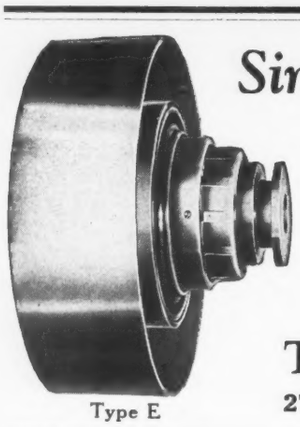
Whitney High Speed Silent Chains on hand. Driving Sprockets of Steel, Heat-treated and Driven Sprockets of Cast Iron; Rebored, Keyseated and provided with Set-screws to suit your requirements. Catalog.

CULLMAN WHEEL CO., 1339 Altgeld St., Chicago, Ill.

PULLEYS

Cast Iron of all sizes
and every description
THE A. & F. BROWN CO.
ELIZABETHPORT, N. J.

LO-HED ELECTRIC HOIST
¼-ton to 12-ton capacity
AMERICAN ENGINEERING COMPANY
2435 Aramingo Ave. Philadelphia, Pa.



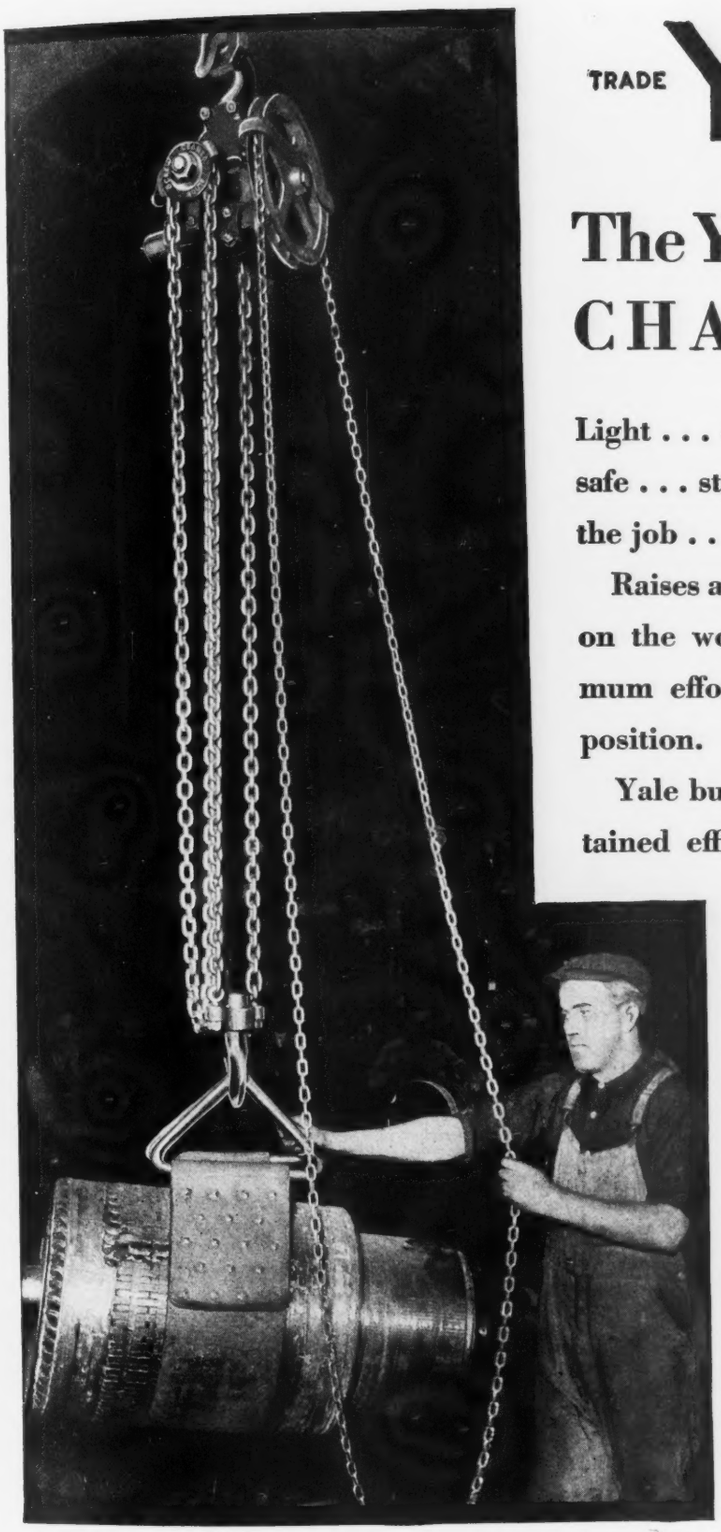
Type E

Simplicity That Is Efficiency

The elimination of non-essentials is the first step to secure really efficient operation in any working mechanism—the simplicity of fundamentally correct design helps insure lasting efficiency and durability of Edgemont Friction Clutches. Single adjustment, rollers in levers and woven asbestos liners are only a few of the features that guarantee long service without breakdowns and repairs.

The Edgemont Machine Company
2700 National Ave. **DAYTON, OHIO, U. S. A.**

Send for Catalog H
of
Edgemont Clutches, Cut-Off Couplings, Clutch Pulleys, Extended Sleeve Clutches and Special Clutches for all purposes.



TRADE **YALE** MARK

The Yale Screw-Geared CHAIN BLOCKS

Light . . . compact . . . smooth running . . . safe . . . strong . . . portable . . . goes right to the job . . . and works there.

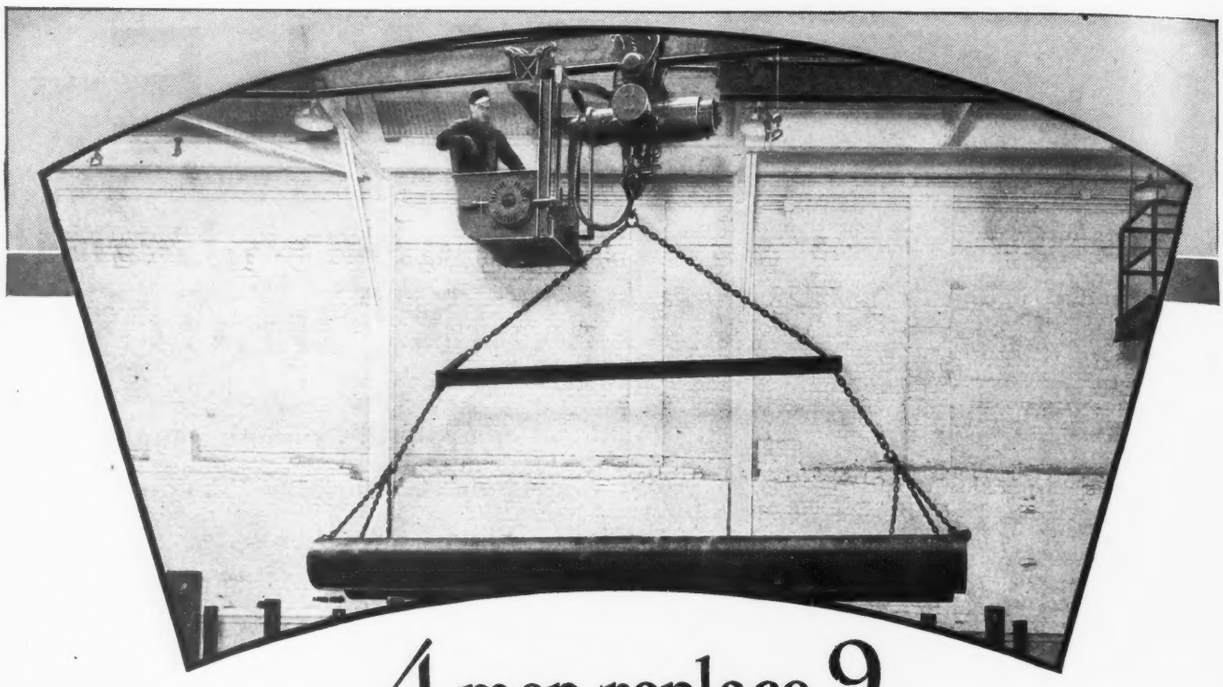
Raises and lowers loads quickly . . . operates on the worm and screw principle . . . minimum effort . . . holds load securely in any position.

Yale built throughout . . . maximum maintained efficiency . . . adaptable to horizontal work when pulling heavy loads on rollers or skids.

THE YALE & TOWNE MFG. CO.
Stamford, Conn., U. S. A.

YALE MARKED IS YALE MADE

Hoisting and Conveying Systems



4 men replace 9
by *planned load handling!*

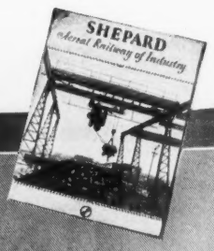
9 men released from the tiresome, costly job of handling pipe by hand. 4 men and a Shepard Monorail System employing two Shepard Cage Operated Hoists now do the job with ease. Handling costs are greatly reduced and the pipe is handled with greater speed and safety.

Such are the benefits derived from Shepard's planned load handling in one of the Crane Co. Warehouses. They are typical of the Shepard economies which are being enjoyed to an ever increasing extent by practically every branch of industry—because Shepard builds hoists in more than 5000 types and sizes, a line so complete as to provide the ideal hoist for every job.

Such features as the Shepard "Balanced Drive," automatic oil bath lubrication, total enclosure and unit construction are representative of the thoroughness of Shepard design. They contribute to the dependable, economical material handling which every Shepard Hoist assures.

Many interesting and profitable applications of Shepard Cage Operated Hoists are described and illustrated in the "Aerial Railway of Industry" Bulletin. Write for a copy.

SHEPARD NILES CRANE & HOIST CORPORATION
380 Schuyler Avenue, Montour Falls, N. Y.
Works: Montour Falls, N. Y. Philadelphia, Pa.



SHEPARD
CRANE & HOIST DIVISION

PRODUCTION TRAFFIC

Keep it rolling with ROLLER BEARING CRANES

TODAY'S production, stupendous in volume and amazing in speed, needs modern handling equipment to maintain its pace. Its "heavy traffic" must ever be kept moving to avoid the penalties of congestion and its attendant delay of men and machines.

Milwaukee Roller Bearing Cranes are fully adequate to the fast pace of present day production. Easily, swiftly, and surely they carry their loads, with every bearing—a roller bearing! The work of men and machines is accelerated when these cranes serve them.

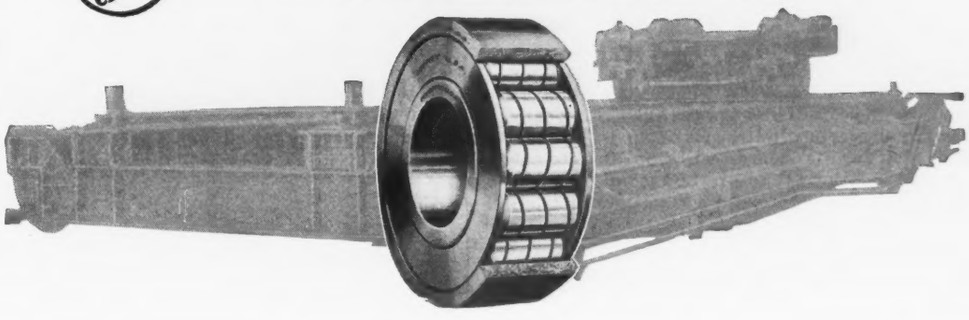
Roller bearing advantages are many: less starting effort, lively "pick-up", low cost upkeep, power savings. And Milwaukee Roller Bearing Cranes have them in full measure, for they are designed for roller bearings and built with roller bearings from motors to bottom block. (Milwaukee was the first crane builder to produce a traveling crane completely engineered for and equipped with roller bearings) . . . On your next crane requirement investigate what Milwaukee has to offer you in the way of greater crane efficiency.

MILWAUKEE ELECTRIC CRANE & HOIST CORP.
MILWAUKEE *Representatives in Principal Cities* WISCONSIN

HOISTS MILWAUKEE CRANES ROLLER BEARING CRANES

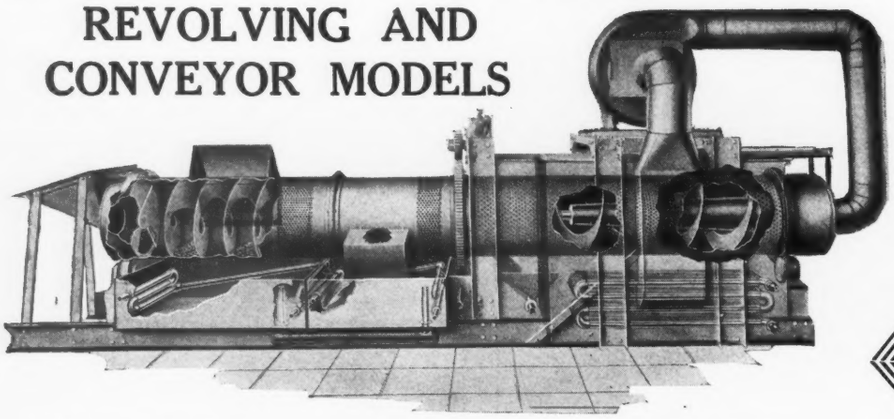
MILWAUKEE

Low Headroom Cranes—3 to 30 Tons
Standard Cranes to 50 Tons



COLT AUTOSAN

REVOLVING AND CONVEYOR MODELS



A COLT PRODUCT

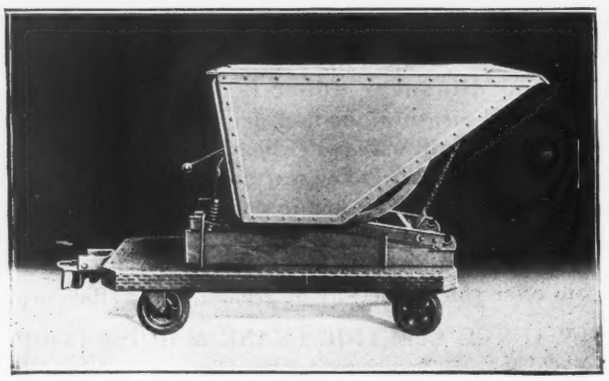
For Cleaning and Drying Everything—
From Silverware to Crankcases

Cleaning parts in process—any kind and almost every size—is a part of the production job put on a modern basis by Colt Autosan.

The model 28 Revolving Type Colt Autosan shown, is particularly adapted for such small parts as nuts, bolts, rivets, screws, stampings, etc.—reducing costs on cleaning operations as much as 70% by cleaning, rinsing, drying such parts in one passing through the machine—the manufacturer saves floor space and guarantees the best possible kind of job. Conveyor models are especially adapted to cleaning larger parts and castings.

Ask about Colt Autosan Equipment for your work. Let us tell you about profitable installations in other well known plants. The Autosan Drying Section is available as a separate unit.

COLT'S PATENT FIREARMS MFG. COMPANY, Autosan Machine Division **Hartford, Conn.**



Clark Trailer (Code: "Chips"). Hopper body of 24 and 30 cu. ft. capacity on 1- or 2-ton trailer chassis. Over-all height, 53 in.; length, 89 in.; width, 41¾ in.

Clark Chip Trailer

Quick, Economical Clean-up

"Chips" handles coal, ashes, refuse,—any bulk material,—but serves as nothing else can when scrap loads are to be collected from several stations. Placed at aisle intersections in factories and shops, this dump-body trailer accumulates refuse until picked up by tractor. Dump clean, spotting its load directly into the freight cars or on the dump heap. Secure full details by clipping this ad and sending it with your name and address to

CLARK TRUCTRACTOR COMPANY
Battle Creek, Michigan

Lift Electrically

Why pull—tug—strain and waste your time with slow lifting methods when the ROEPER TYPE "R" Electric Hoist will do the work twenty times as fast?

The price is surprisingly low. Send for Bulletin.

ROEPER CRANE & HOIST WORKS, Inc.
Member of Electric Hoist Manufacturers Association
1740 N. 10th Street, READING, PA.

LONGER LIFE FOR MACHINERY

Give your machinery longer life by pulling out the grit and dirt with the

IDEAL Portable Vacuum Cleaner

Ideal Commutator Dresser Co., 829
1011 Park Ave., Sycamore, Ill.
Please send me an Ideal Portable Vacuum Cleaner on 5 days free trial.
Specify voltage.....and cycles if A.C.
Name .....
Address .....
City and State.....

Irresistible suction of 210 miles per hour. No installation expense. Operates from power or light circuit.

Try out the Ideal five days free! Improved efficiency of machines will amaze you.

Specify voltage and cycles if A.C.

And still older service records are coming to light, revealing that Arguto Bearings scarcely ever wear out—never require attention and never a drop of oil.

22 YEARS

25 YEARS

29 YEARS

20 years without a drink—

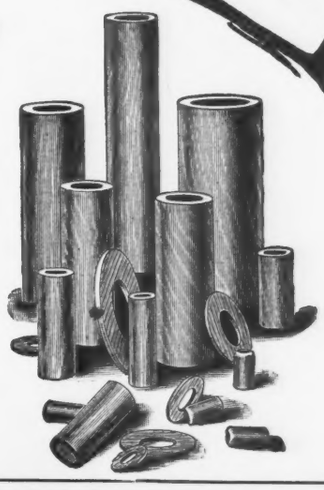
ARGUTO OILLESS BEARING CO.

Wayne Junction, Philadelphia

20 years without a drink—

20 years without a drink—

20 years without a drink—



"We like 'ARGUTO' Bearings and use them and specify them whenever we can, because we believe all parties are benefited by the transaction. Unless all parties are benefited the transaction cannot be classed as 'good' Business."

The above statement was made by the President of one of the World's Leading firms of Consulting Engineers.

No. 251-D

Are You Overlooking This Economy ?

No matter what method—if any—you are now using to reclaim your used cutting oil, you are daily throwing out gallons that could be used over and over again.

Reclaiming with Barrett Centrifugals saves 90%—three times as much as ordinary methods. Figure up what 60% of your yearly cutting oil amounts to—then write to us for the full story. You'll be interested!

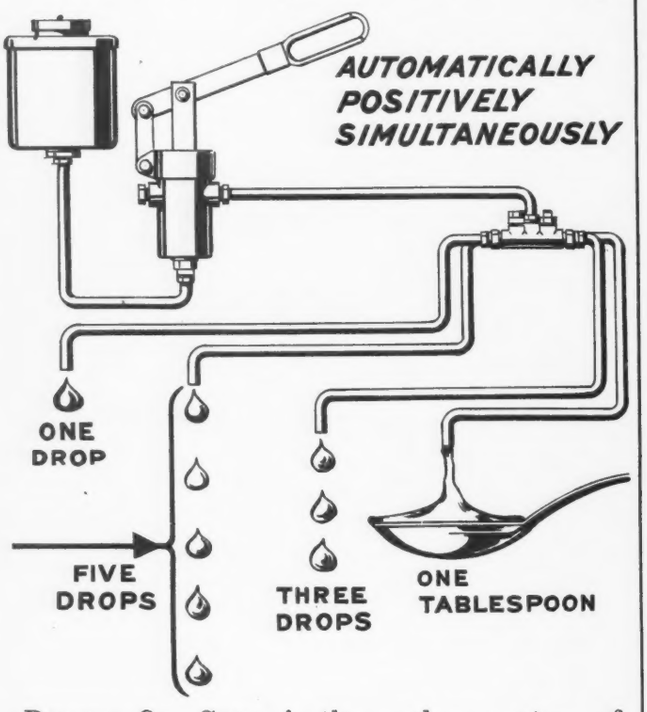
THE LEON J. BARRETT CO.

Successor to Curtis Machine Company

1475 Grafton Street WORCESTER, MASS.

Centrifugal Dryers *Curtis Oil Extractors*

The Correct Quantity of Oil to Every Bearing

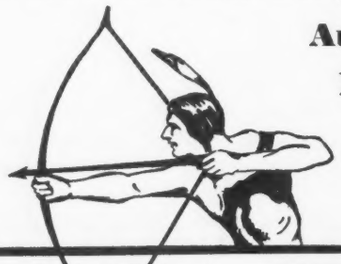


BOWEN OIL SHOT is the modern system of lubrication for industrial machines. One stroke of the plunger and the entire machine is oiled—each bearing receives the proper amount whether it requires one drop of oil or a tablespoonful.

Unfailing in operation, the BOWEN System provides positive, effective lubrication at a cost far less than obsolete hand methods. Production shutdowns resulting from improper oiling are avoided, repair expenses saved, operating and overhead costs reduced by this economical system. An interesting booklet describes BOWEN OIL SHOT fully. Write for a copy.

Bowen Products Corporation

Auburn, N. Y.



BOWEN OILSHOT SYSTEM

"ONE SHOT DOES THE TRICK"

Ajax Metal

for Better Bearings

As makers of all kinds of babbitts, we unhesitatingly recommend Ajax Bull Bearing Alloy for 99% of all bearing relining jobs. It runs cooler, wears longer and costs far less than ordinary babbitt.

Ajax Bull Bearing Alloy is made from the finest Virgin Metals to a scientifically correct formula by the Ajax Process. An interesting booklet entitled "Babbitt Facts" explains why Ajax Metal improves bearing service. Write for a copy.

The Ajax Metal Co.

PHILADELPHIA

Established 1880

NEW YORK CHICAGO CLEVELAND

These Three Drains On Profits

Now Easily, Cheaply, Quickly Stopped, Say Experts. Read These Facts

IT is the unseen, too frequently disregarded leaks that drain profits in any manufacturing business. Leaks that industry has put up with too long.

Here are three of the most unnecessary and costly leaks:

1. Bearing troubles and consequent breakdowns.

2. Excessive lubricating labor cost.

3. Wasted lubricant—a pint for the floor and product in process to every pint that goes into the bearings.

Alemite High Pressure Lubrication Systems prevent 75% of bearing troubles and consequent costly shutdowns. Save 50% and more in lubricating labor and lubricant. Lubrication is easy—so it is not neglected. Sure—so it is done right. With Alemite Systems every bearing is easy to reach for lubrication. Each receives a sufficient quantity of lubricant—yet there is no wasted lubricant to stain floors, to spoil the product being manufactured or handled.

Manufacturers of machinery know that proper lubrication means longer life, greater efficiency, freedom from repairs. So more than 600 leading manufacturers of machinery equip their product with Alemite.

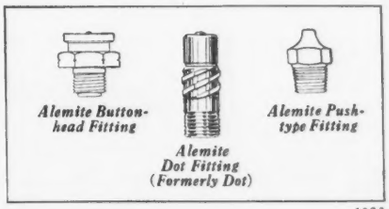
But you do not need to wait for new machinery to secure the advantage of Alemite High Pressure Lubrication and Alemite Lubricants.

Alemite fittings are made to fit present oil holes and replace oil and grease cups. The installation requires only a few minutes.

And the cost is small—yet an Alemite fitting, costing only a few cents, may save a bearing which would cost many dollars to replace, in material, in labor and loss of productive time of the machine.

And with this system lubricant is handled from Barrel-to-Bearing without even exposing to air or wasting an ounce.

In every line of industry, from bakeries to steel mills, you will find Alemite Lubricants actually saving many times their original cost each year.



1022

ALEMITE

High Pressure Lubrication for Modern Industry

Alemite Lubrication Saves $5,000 a Year for a Cigar Manufacturing Plant

Formerly two men spent their full time oiling and cleaning 40 machines. Now one man alone maintains 88 machines. Each machine is cleaned and lubricated once a week.

Officials of the company conservatively estimate their savings on labor, material, and prevention of shutdowns to be more than $5,000 during the first twelve months. Two hundred additional automatics recently added to the Philadelphia plant were immediately equipped with Alemite fittings.

Learn how Alemite can be profitably applied to your present equipment. Learn how other manufacturers in your industry are effecting savings. An Alemite representative will be glad to give you a demonstration at your convenience—without obligation on your part. Write for complete information.

Alemite Corporation (Division of Stewart-Warner), 2678 North Crawford Avenue, Chicago, Ill. Canadian address: The Alemite Products Company of Canada, Ltd., Belleville, Ontario, Canada.

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CONSTANT SERVICE PUMPS

A constant full flow of coolant, non-clog construction, design that eliminates wear on the pumping part! Fulflo Pump features insure pump service that enables the grinding wheels to do efficient work under the best wet grinding conditions.

Cut shows the Fulflo Belt Driven Grinder Pump, capacity 35 gallons at 1800 R.P.M. Also made in other sizes and capacities. Send for details of Fulflo Belt and Motor Driven Pumps.

FULFLO SPECIALTIES COMPANY
BLANCHESTER, OHIO

For Retaining Molten Babbitt Metal While Pouring—

Use—*Babbitrite*

AS NECESSARY AS THE LADLE

Modern shops, anxious to eliminate dangerous, costly, time-killing methods, of retaining molten metal, have turned to BABBITRITE.

A "ready for use" compound, BABBITRITE is safer, cheaper and easier to work than clay or putty.

SAFER—because BABBITRITE cannot melt or blow out.

EASIER TO WORK — it comes already prepared, eliminates time-killing mixing and saves labor.

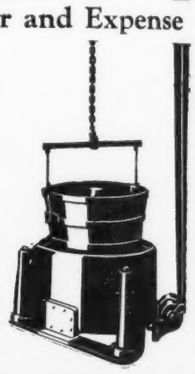
CHEAPER—because BABBITRITE can be used over and over at least 100 times.

You will pour better bearings, quicker and more cheaply, with this modern retaining compound. Send for a generous free sample.

Products Manufacturing Co.
MILWAUKEE, WISCONSIN

Tolhurst Chip Wringers Save the Oil and Save in Labor and Expense

One Reclaiming Department had ten small (1 and 2 bushels) machines. They installed one 48″ and a 40″ Tolhurst, replacing all small machines and eliminating eight operators.



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TOLHURST MACHINE WORKS, Inc.
TROY, N. Y.
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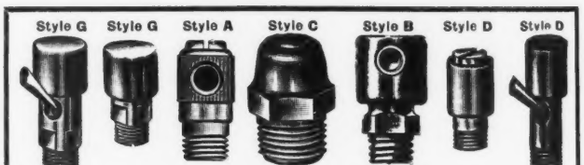
Chicago Office: 8 So. Dearborn St.



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Oil Hole Covers

ALSO
SHEAR AND ROD CUTTERS
AND
SCREW MACHINE PRODUCTS

A Type for Every Service

SEND FOR REVISED CATALOGUE

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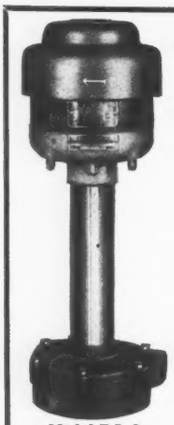
FOREIGN AGENTS: Fenwick Freres & Co., Paris, France.
Alfred Herbert, Ltd., Yokohama, Japan.



"GUSHER" COOLANT PUMPS

&

Greater pumping capacity on less power

Write for information

The Ruthman Machinery Co.
Front and Pike Streets
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Model T-L-O

Hjorth Perfection Spring Winder

No factory complete without one. Makes every kind of springs. Right or left-hand.
Capacity to 3/32 wire **$1.25**
Capacity to 3/16 wire **2.50** *If interested*
Capacity to 5/16 wire **5.00** *send for circular*

(Patented)

Hjorth Lathe & Tool Company
24 School St. Boston, Mass.
Works: Woburn, Mass.

Flexible Steel Tubing

For carrying coolant on machines.
Our specialty for seventeen years.
Sizes: 1/8-, 1/4-, 3/8- and 1/2-inch inside diameter.
WHEELOCK MFG. CO., Wheelock, Vt.

What expectation of Service?

IN the mind of every purchaser of industrial equipment there frequently arises this question: How long a period of service can this equipment be expected to give before extensive repairs or replacements will be necessary?

Proper lubrication is a definite, positive factor in answering that question, in determining the expectation of equipment life and operating efficiency. Probably no other element entering into equipment maintenance will pay larger dividends if studied carefully and intelligently, than lubrication.

So important did one large manufacturing company consider lubrication in preserving the life of equipment, that they requested Standard Oil Company (Indiana) engineers to make a study of their lubrication requirements.

Today, one year later, lubrication costs have been reduced approximately 25 per cent and maintenance has been cut in half.

During the period covering more than a third of a century in which we have been studying and solving the lubrication requirements of industry, we have developed lubricants for every type of moving mechanism. Proper lubrication in your plant is assured if you avail yourself of the service of our lubrication engineers. Their services are free and place you under no obligation. If you have a lubrication problem call in one of these men.

THIS WILL INTEREST YOU

Our engineering bulletin "Maintaining the Quality of Lubricants in Service," is a thorough treatise on the subject. Any plant executive reading this bulletin can not fail to realize what an important factor the care of lubricants is.

We will be glad to send you a copy of this bulletin at your request.

STANDARD OIL COMPANY (*Indiana*)

General Offices: 910 S. Michigan Ave. CHICAGO, ILLINOIS

Davenport	Duluth	Green Bay	Kansas City	Milwaukee	Saginaw	South Bend
Decatur	Evansville	Huron	La Crosse	Minneapolis	St. Joseph	Quincy
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1429

The Perfect Lubricant for All Speed Reducers

THE lubrication of Speed Reducers presents an unusual problem.

Working under a wide variety of services, the Perfect Lubricant must be adapted to a wide range of conditions — light, continuous loads at high speed; heavy, grueling punishment that fluctuates from "full speed ahead" to "reverse"; heat, abrasive dust, gases, corrosive vapors and all that. The grease that does the job must be *trouble proof*. And it must be, not only *gear grease*. It must assure the perfect functioning of bearings. Plain, roller, ball — chain oiled, force oiled or splash; all kinds of bearings must be lubricated, as well as all types of gears.

Delco No. 410 is our recommendation because we have proven it to be a perfect lubricant in countless tests. If your requirements embrace some extraordinary service factor—ask Lindsay-McMillan prescription Grease Service for recommendations.

LINDSAY-McMILLAN CO., *Milwaukee, Wisconsin*
Dept. D-8

Delco
REG. U.S. PAT. OFF.

INDUSTRIAL OIL-PRODUCTS

LINDSAY-McMILLAN CO. MFGRS.
MILWAUKEE WISCONSIN
Plants: Savannah-Milwaukee

Can You Pick the Best Motor?

It is the dollars-cost-per-unit of productive capacity that determines the economy of one type of motor over another, not the dollars per horsepower. Wagner has built up a well-rounded motor service to industry . . . Wagner makes every commercial type of a. c. motor.

Whatever your requirements, Wagner can recommend without prejudice the right motor for the job.

Literature on Request

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Wagner Sales Offices & Service Stations in 25 Principal Cities

Products: FANS . . . . Desk, Wall and Ceiling
TRANSFORMERS . . . Power, Distribution and Instrument
MOTORS . . . Single-phase, Polyphase and Direct Current

Wagner ...quality

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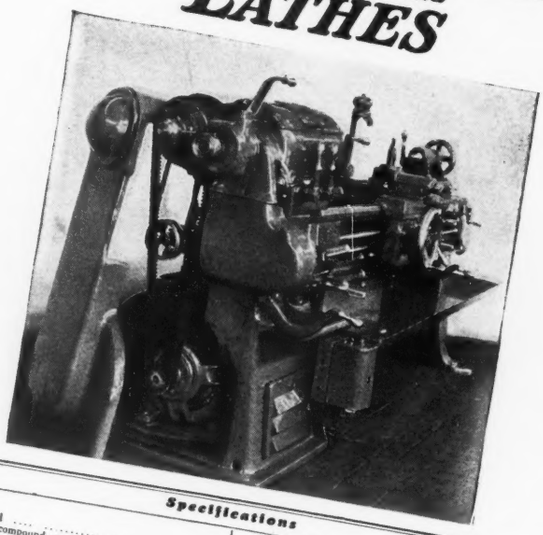
electrified

REED-PRENTICE
Sliding Gear Head
LATHES



Specifications

Range:	**Threads, with Quick Change Gear Mechanism:**
Swing over bed ..... 16½"	Number 41
Swing over compound rest ..... 11"	Range, per inch ..... 3—96
Takes between centers, 6' bed, tailstock flush ..... 31½"	Leadscrew, diameter and pitch ..... 1⅛"—4P
Steady rest capacity ..... 4½"	**Bed:**
Tool post takes tool ..... ⅝"x1¼"	Width x depth ..... 13¾"x10"
Headstock Spindle:	**Carriage:**
Front bearings ..... Precision Timken	Bearing on ways of bed ..... 25½"
Rear bearings ..... Precision Timken	Cross feed screw, diameter and pitch, Acme ..... ¾"—5P
Hole through spindle ..... 1⅞"	Width x depth ..... 6¾"x3"
Taper hole in spindle Morse taper (#4 center) ..... #5	**Floor Space:**
Spindle thread, diameter and pitch ..... 2¾"—4P	6' bed, length x width x height ..... 7'x3'x4
Tailstock Spindle:	**Weights:**
Diameter ..... 2¼"	
Taper hole in spindle, Morse taper ..... #4	
Speeds:	

EXTREME simplicity marks the new Reed-Prentice line of lathes—for example, only 9 gears are used for 8 spindle speeds in the headstock.

And, befitting such simplicity, this line is furnished with G-E "built-in" motor and controller—an arrangement that gives compactness, refinement, accuracy, and many other advantages essential to efficient, economical production.

This is another example of the modern trend, which promotes utility by making G-E Motorized Power an integral part of the machine.

More and more, manufacturers are working with G-E machine tool specialists in putting G-E motors and G-E control on their machines.

Specify G-E Motorized Power and you get a modern electrified machine.

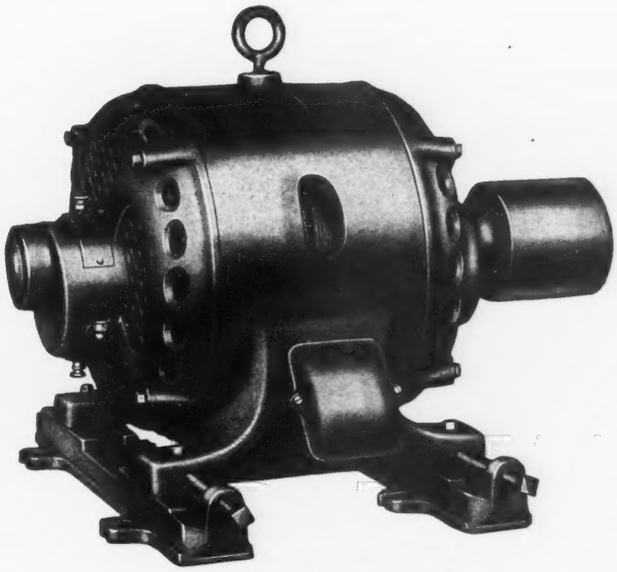
Motorized Power
—fitted to every need

200-266

JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY SATURDAY AT 8 P.M., E.S.T. ON A NATION-WIDE N.B.C. NETWORK

GENERAL ELECTRIC

GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y., SALES OFFICES IN PRINCIPAL CITIES



20 Horse Power Century Type SC
Multi-Speed Constant Torque Squirrel Cage Induction
3 and 2 Phase Motor

MULTISPEED

Constant Horse Power Motors
Constant Torque Motors
Variable Torque Motors

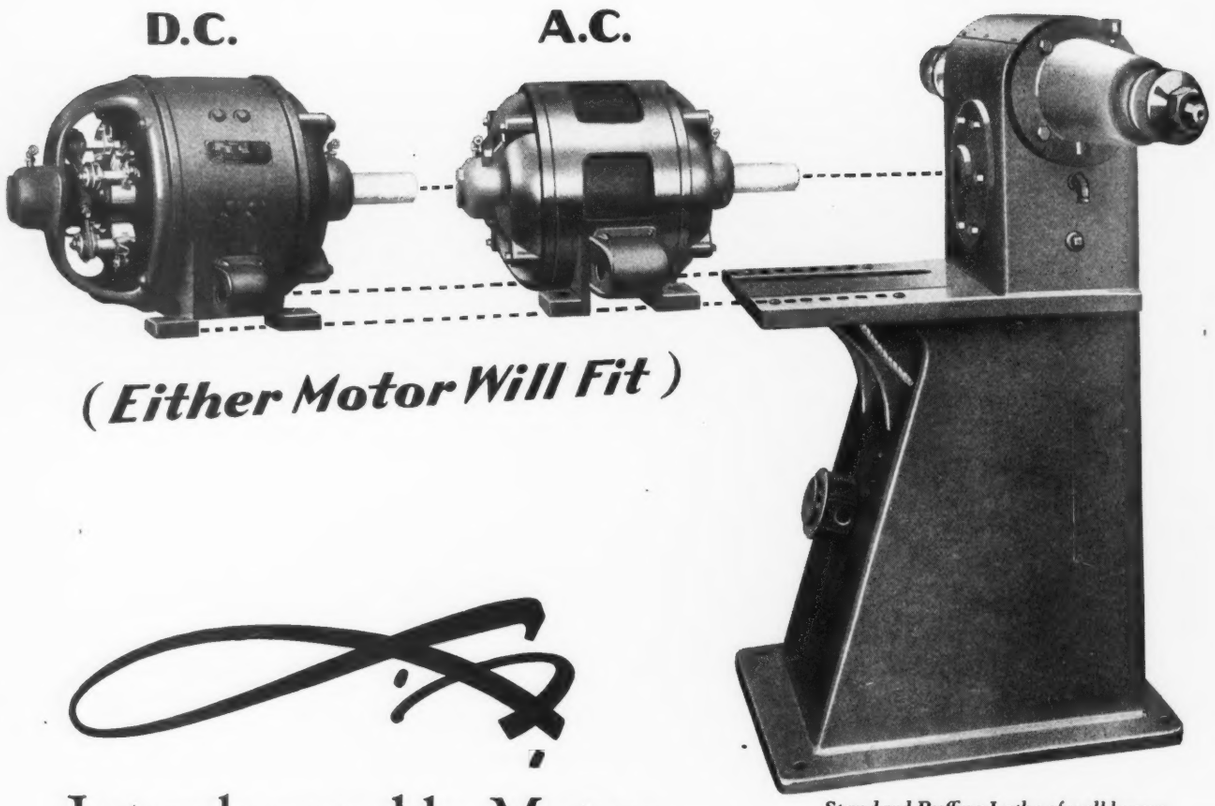
Because the power demand of Multi-Speed Motors is in direct proportion to the horse power rating at a given speed, they are economical in operation, and are recommended wherever adjustable-speed motors are desirable—as in machine tools, woodworking machinery, printing presses, dough mixers, fans, blowers, and similar apparatus.

They are built regularly for 2, 3, and 4 speeds, with wide or narrow speed ranges like 1800-1200 or 1800-600 down to 900-450 r. p. m. (60-cycle). Special speed combinations available. Temperature rating, 40° C.

CENTURY ELECTRIC COMPANY
1806 Pine St. St. Louis, Mo.
40 U. S. and Canadian Stock Points and more than 75 outside thereof

Century MOTORS

"THEY KEEP A-RUNNING"



Interchangeable Motors

Standard Buffing Lathe of well known make. Driven by 5 h.p. 1750 r.p.m. motor. Equipped exclusively with Louis Allis motors.

Simplify Your Motor Mounting Problem!

The buffing lathe here shown illustrates how Louis Allis interchangeable motors simplify the problem of motor mountings. Either the a.c. or d.c. Louis Allis motor can be mounted on the lathe without change in the bracket, bolt hole drilling, or in the lathe itself—because both motors have the same mounting dimensions.

To assist machinery builders, this feature of interchangeability has been incorporated into the entire line of Louis Allis motors to the greatest extent possible. Not only are most standard a.c. and d.c. motors made with important mounting dimensions the same, rating for rating—but, in addition, vertical and other special types, and motors of different ratings and frequencies are made mechanically interchangeable.

The resulting savings—in pattern and fixture costs, machining operations, stocks, etc.—are obvious to machinery builders. Advantages like these explain why more and more machinery builders are standardizing on L.A. interchangeable motors.

Why not do the same? You, too, may be able to simplify your motor mounting problem by standardizing on Louis Allis motors for your entire line of machines. May we tell you more about L.A. interchangeable motors?

LOUIS ALLIS

"CUSTOM-BUILT" MOTORS

THE LOUIS ALLIS CO., Milwaukee, Wis.

Motor specialists for 28 years *Offices in principal cities*

To the letter as well as the spirit

HERE at Robbins & Myers we have had our ups and downs. We have known the fat years and the lean, boom times and panic, and we are a little prideful of the fact that in over half a century no customer has ever once complained of a breach of faith. The good name of Robbins & Myers—and the standard of workmanship it stands for in the world—is a family tradition handed down through successive generations.

And so long as any of us are alive we shall continue to give our customers what our long experience tells us they need rather than what they unknowingly may order, that R & M Fans and Motors may continue to give "plus" service wherever they are employed. Often it means less profit to us, but a far wiser man than we once truly said, "a good name is more to be desired than great riches."

If you have a problem in electrical-motored machinery come to Robbins & Myers. We offer you the facilities of a completely modern plant, and the experience of 31 years' precision manufacture in designing, building and applying electric motors, generators, fans, and electrical appliances

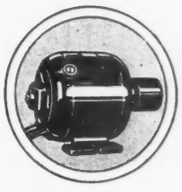
Partial List of Apparatus to which Robbins & Myers Motors have been successfully applied

Adding Machines	Confectioner's Machinery	Humidifiers	Movie Projectors
Advertising Displays	Conveyors	Ironing Machines	Portable Tools
Air Compressors	Dental Lathes	Labeling Machines	Printing Presses
Baker's Machinery	Dish Washers	Oil Burners	Spray Equipment
Blowers	Driers	Office Appliances	Ticket Selling Machines
Brick Machinery	Floor Surfacers	Organ Blowers	Vacuum Cleaners
Churns	Folding Machines	Mailing Machines	Ventilating Fans
Cloth Cutters	Heaters	Machine Tools	Unit Heaters
Coffee Mills	Heat Regulators	Meat Choppers	Washing Machines
Coin Counters	Hoists	Milking Machines	Wrapping Machines

Robbins & Myers, Inc.

Springfield, Ohio **Brantford, Ontario**

1878

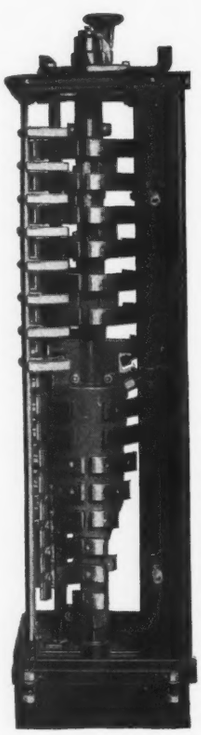


1929

UNION

The Most Complete Line of Drum Controllers in the World

Cylinder Construction



Non-Reversing Type. Cylinder is a one-piece brass or aluminum casting.

Reversing Type. The brass or aluminum rotating cylinder consists of only three pieces — two castings for the primary switch mechanism and one casting for the rotor circuit.

Mounting. Castings are mounted on a square steel shaft, insulated by a square tube of mica 1/8 inch thick. Break-down voltage 60,000 volts.

Perfect Contact Surface. The two castings used on the primary are joined electrically by electrical brazing. Clamping bolts carry no current. After assembling, the cylinders are ground absolutely true to size, with a perfect contact surface to which the copper segments are attached.

Segments. Soft drawn copper, cold pressed to shape. Inside of segments are lapped, cleaned in an acid bath; fastened to the cylinder with cadmium plated screws. Segments are renewable.

Bearings. Arguto Oilless Bearings at both ends of cylinder shaft. Under the steel thrust washer which supports the cylinder at the lower end of the shaft there is placed an Arguto Thrush Washer. This combination makes operation of the controller free and easy at all times.

For complete details see our Publication 500

UNION ELECTRIC MFG. CO.
928 Juneau Ave., Milwaukee, Wis.

Manufacturers of

Electric Motor Control Apparatus

Also Associated Manufacturer with, and Eastern Distributor for
DIAMOND ◈ ELECTRICAL MFG. CO., *Los Angeles, Cal.*
Magnetic Motor Control Apparatus

What are your servicing COSTS?

For the manufacturer who is having high service costs on his most difficult motored equipment, Zobell has a message that may save him thousands of dollars.

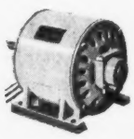
Zobell Custom-Built motors in quantity designed to meet your special requirements cost little if any more. We will gladly show you our service records of more than 17,000 Zobell motors on cranes, hoists, and other difficult jobs.

Patented features—quick deliveries on special shaft extensions, due to removable shaft design.

Complete special designs if desired.

Sizes 1 to 15 H.P., A.C. or D.C.

Let us figure your worst motor application first.



ZOBELL
HIGH TORQUE MOTORS

ZOBELL ELECTRIC MOTOR CORPORATION
GARWOOD, NEW JERSEY. ⊕ 2980

Welders

TAYLOR-WINFIELD

is a pioneer in electric welder development. In any type of welder bearing this name you can be sure of securing maximum efficiency and economy, the result of specialized knowledge and skill in producing welders for industrial requirements. Write.

THE TAYLOR-WINFIELD CORP.
WARREN, O.

Offices in principal industrial centers

SPOT-BUTT
SEAM
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OXY-ACETYLENE
Welding and Cutting Equipment
Outfits, Torches, Regulators and Automatic Acetylene Generators.
THE IMPERIAL BRASS MFG. CO., 531 So. Racine Ave., Chicago

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Are in demand in machine tools for the transmission of high pressure fluid power, lubricating lines and wherever secure joints are essential.

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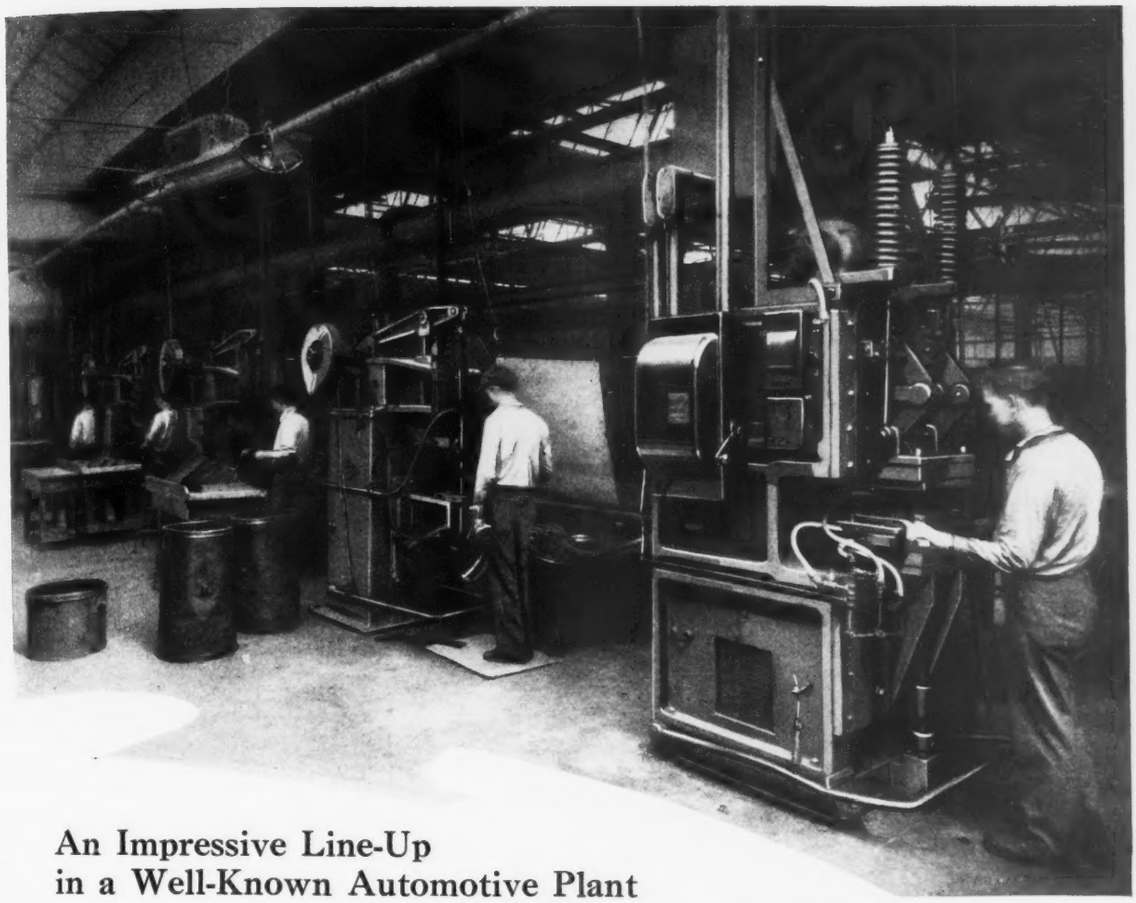

An Impressive Line-Up
in a Well-Known Automotive Plant

FEDERAL
SPOT & PROJECTION WELDERS

Welding plays a large part in the production of the modern motor car. Recent developments in welding methods, with Federal machines well to the fore, have made possible improvements in design, better finish, greater strength in many parts and *increased production efficiency.*

Federal Welding Service—stressing the development of new methods and machines and their adaptation to special needs—makes Federal popular in this important field. This installation is typical.

Ask Federal Welding Engineers to study your assembly problems and tell you how to solve them economically with correct Federal Welding Equipment.

Federal BUTT SPOT SEAM Welders

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San Francisco—Jenison Machinery Co.

An Amazing New Production Tool

A most unusual but highly successful installation. Welding high-pressure boilers at the Connelly Boiler Company, Cleveland, Ohio. Dimensions are 22 ft. by 3½ ft. by ½ in. The heads are ⅝ in. The efficiency of the welds tests to an average of 97 per cent.

Welding an Ascoloy case-hardening tank at the Boom Boiler & Welding Co., Cleveland, Ohio. The job-welding business of this manufacturer has increased swiftly since the installation of the atomic welder. Unsolicited work comes in from miles around. Welding aluminum candy-cooking kettles, building up high-speed steel dies, repairing special electric-furnace electrodes—no job is too difficult.

JOIN US IN THE GENERAL ELECTRIC HOUR, BROADCAST EVERY SATURDAY AT 8 P.M., E.S.T. ON A NATION-WIDE N.B.C. NETWORK

GENERAL

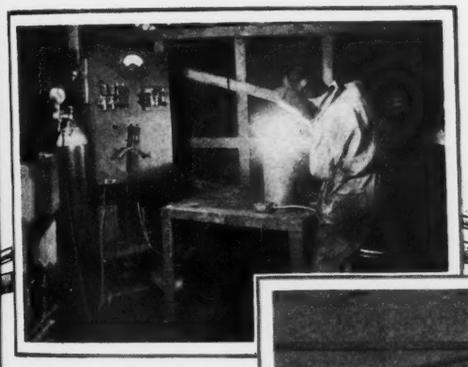
GENERAL ELECTRIC COMPANY, SCHENECTADY, N. Y.

Atomic-Hydrogen Arc Welding

DEVELOPED originally by General Electric to weld very thin metals, and metals and alloys hitherto considered unweldable, the atomic-hydrogen arc welder, in the hands of inquisitive users, has become a production tool of amazing potentialities.

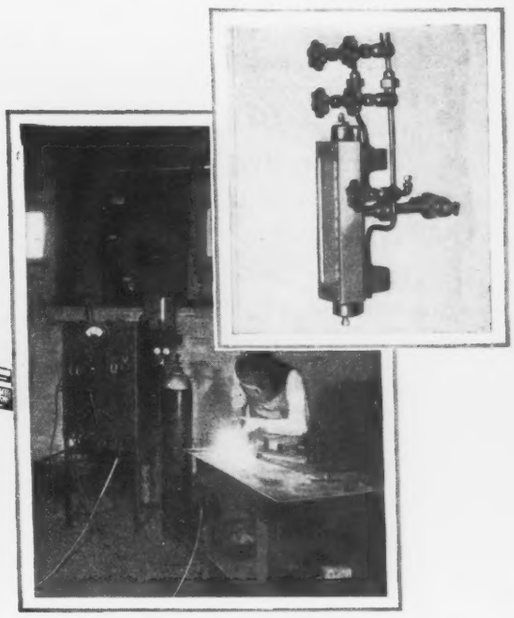
Of special interest to industry is the practice of using the atomic-hydrogen process for general welding. So exceptional are the results produced that users are perfectly willing to pay the slightly increased operating cost involved.

We show here the results being obtained with this new welder in a half-dozen representative plants in a single city. If you are interested, we cordially invite you to visit our installations at the Schenectady works, or call up our welding specialist in the nearest G-E office. He will show you local installations and give you complete data.



The list of unusual welded-repair jobs performed by the Cleveland General Electric service shop, since the installation of its atomic welder, reads like a magician's repertoire. Thousands of dollars were saved for one customer because this equipment made it possible to repair oil-leaks in transformer tanks.

The Perfection Stove Company, Cleveland, Ohio, is one of the largest users to date of this new process. Six equipments are used in the fabrication of parts for refrigerators made by this company. Much faster welding speeds and a quality of weld never before obtainable are the reasons.

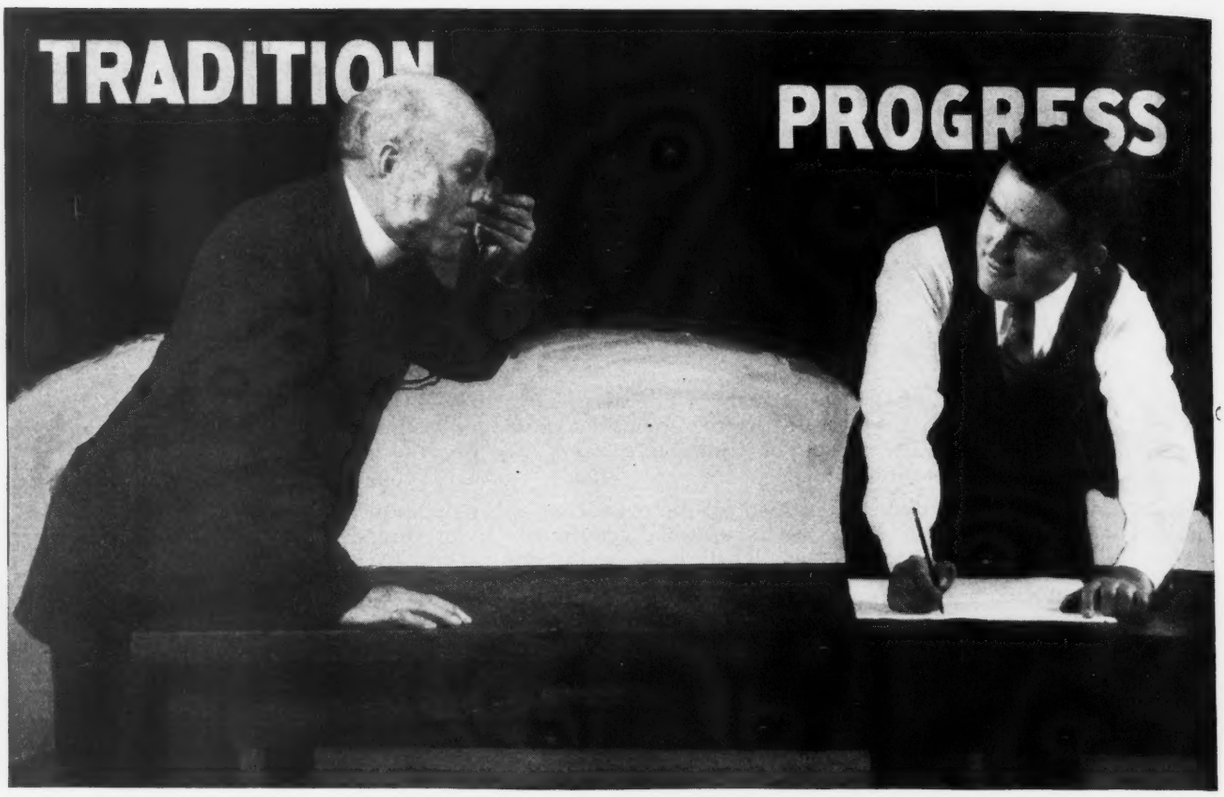


The Meriam Co., a prominent Cleveland engineering firm, is marketing a high-temperature, high-pressure indicating flowmeter fabricated entirely by the atomic-hydrogen arc welder. Every other welding method failed on this job. Furthermore, the smooth weld resulting from this new method obviates any machining before painting.

530-64

ELECTRIC

SALES OFFICES IN PRINCIPAL CITIES



"Here, Lad—

I can easily see where arc welding will be okey for rough, rugged, heavy-duty machines like presses and brakes.

But for our fine precision machinery where *appearance* is of great traditional importance . . . well, arc welders *may* find a parking place in this field by 1999."

"No, Pop—

Already parked by 1929 . . . and here's proof . . . with *appearance* an outstanding feature.

This application sheet* shows how one of the substantial machine tool builders has created a special milling machine out of steel arc-welded with Lincoln 'Stable-Arc' machines.

And let me read you a few of the figures he gives us:

Cost, arc-welded, $485.00
Cost, cast construction, $1100.64
Pattern cost alone was $738.40

—almost double total welding cost. It *would* be double if this had been a production job.

Which proves again, Pop, that a parking place is the spot that another fellow moves into before you can get there."

* Copy on request

The Lincoln "Stable-Arc" Welder

— welds easier
— makes better welds
— permits greater output

because of the steady uniform arc throughout entire welding range, which is the result of:

Variable voltage design
Laminated magnetic circuit
Separately-excited generator field
Double control of welding heat
All steel construction

No other welder has all these features.

The Lincoln Electric Co., Dept. No. 7-8, Cleveland, O.

W-85

"Stable-Arc" LINCOLN WELDER

POWER WELDING

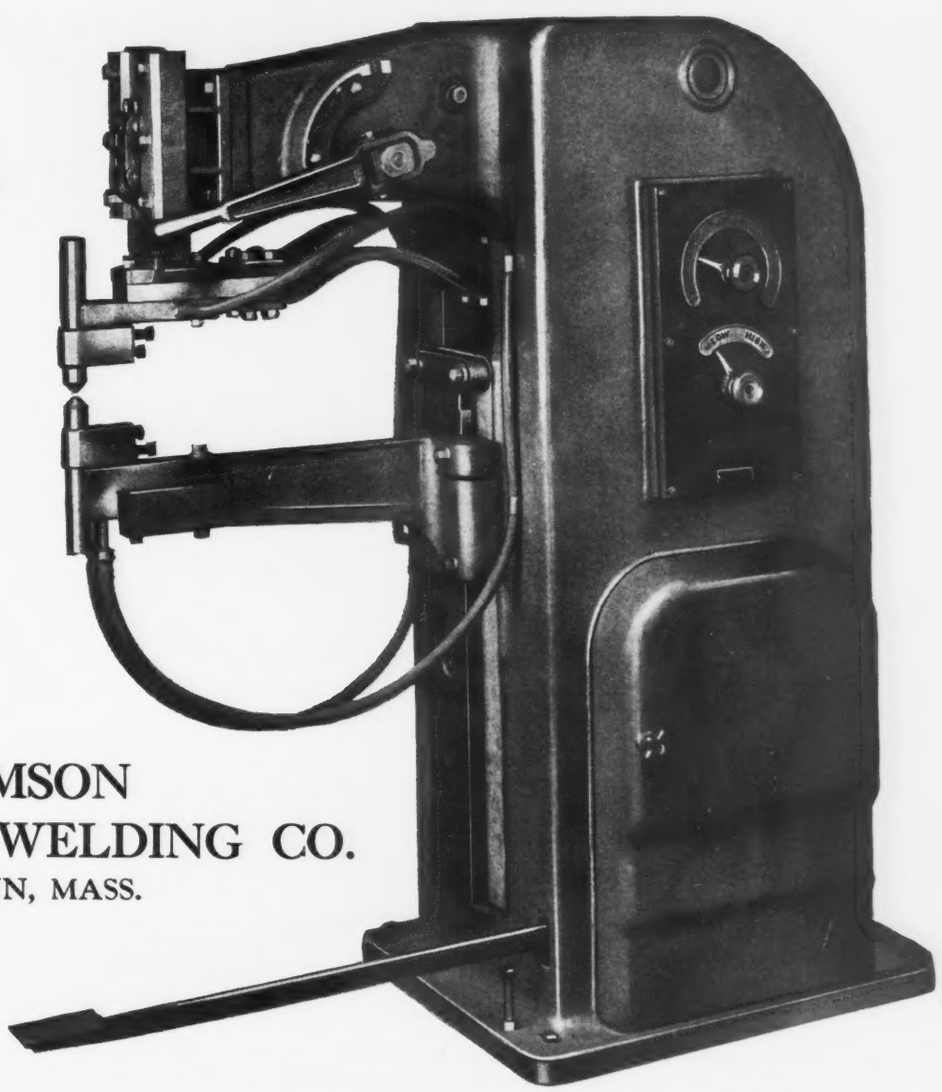
Uniform and Fast

Thomson Electric Welders by putting the burden of production on the machine instead of the operator, lift welding operations —all kinds—into the efficiency class.

Power welding is best for heavy work; where production is being pushed to the limit, or in the plant employing unskilled labor.

POWER DRIVEN SPOT, BUTT OR SEAM WELDERS will handle any operation that can be welded on hand or foot machines and many that cannot. Ask for details of the latest models.

A New Power Driven Spot Welder, No. 275



ELECTRIC THOMSON WELDING

THOMSON ELECTRIC WELDING CO.
LYNN, MASS.

HOT SPOT WELDS

Increase Production!

Save Time!

Save Money!

and do a better job!

Descriptive Bulletins Now Ready

Write for Your Copies

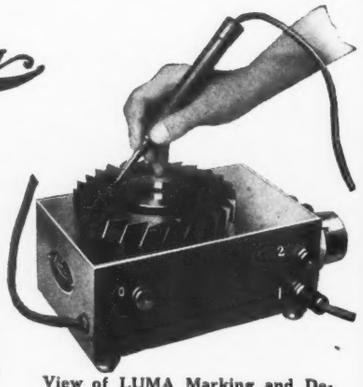
·ACME ELECTRIC WELDER COMPANY·

Warehouses in Principal Cities

5621A Pacific Boulevard , , , Los Angeles, California

Luma

Portable
Foolproof
Durable
Used on A.C. Light Circuit



View of LUMA Marking and Demagnetizing hardened steel tool in same operation.

Marks hardened steel tools, samples of steel metallurgical specimens, special fixtures, etc., permanently and quickly with department and operation identification.

No fuss or muss

Demagnetizes large steel blocks, or small steel tools instantly and thoroughly. A time and labor saving combination well worth investigating by any plant manager.

Luma Electric Equipment Co.

P. O. Box No. 132, Main Office

Dept. M. TOLEDO, OHIO

Steel Spacing Washers

Send for free samples in the sizes you use most. Stock sizes for arbors of the following diameters:

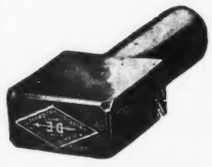
⅜, ½, ⅝, ¾, ⅞, 1, 1¼, 1¼, 1⅜, 1½, 1⅝, 1¾, 1⅞, 2, 2¼, 2½, 2¾, 3, 3½ and 4 inches and larger.

Stock Thickness: .001, .002, .003, .004, .005, .006, .007, .008, .010, .012, .015, .020, .025, .032, .047, .063, .093, and .125 inch.

Spacers thicker than ⅛" are turned from tubing or bars but not carried in stock.

DETROIT STAMPING CO.

3445-3459 West Fort St. DETROIT, MICH.



They're a work of art

Noble and Westbrook Engraved Roll Steel Dies and Press Stamps are made of the best quality steel by skilled workmen. You'll appreciate their artistic effect when you use them. Get the particulars.

The Noble & Westbrook Mfg. Co.

Manufacturers of Rapid Production Marking Machines, Machines for Automatic Numbering on Metal, Steel Stamps, Brass Checks, etc.

Hartford, Connecticut, U. S. A.

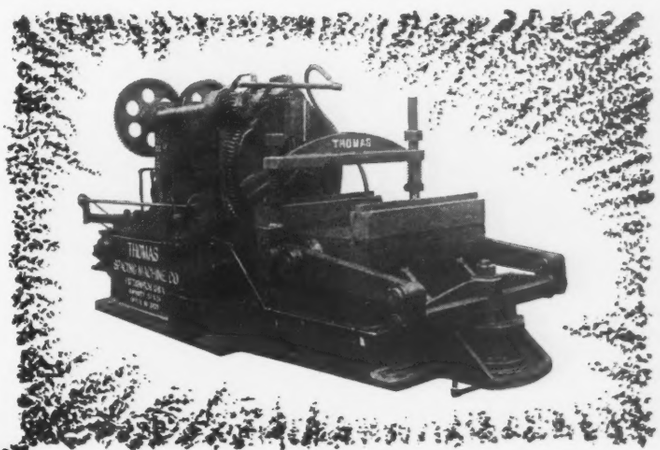
ENGRAVING MACHINES

MARKING MACHINES
GRADUATING MACHINES
ENGINE TURNING MACHINES
RUBBER STAMP VULCANIZERS

H. P. PREIS & CO., Inc., 227 Fulton Street, NEW YORK

Westinghouse-Nuttall Gears

for NEW Thomas Tools



Column facing machine with Westinghouse-Nuttall spur and helical gears.

24-spindle multiple drill. The arrow indicates the chest of 98 gears.

RECENTLY the Thomas Spacing Machine Company, Pittsburgh, devised two new machines for working structural steel girders—a column facing machine and a 24-spindle multiple drill. Both developments mark new attainments in modern machine tool practice.

Sharing in these accomplishments is Westinghouse-Nuttall gearing.

On the column facing machine, helical gears for the main drive give surprising rigidity and a continuous, steady application of power to the facing head that could not otherwise be gained. The result is a column face which is smooth and devoid of cutting tool marks.

Driving twenty-four spindles simultaneously on the multiple drill is accomplished through 98 gears compactly assembled in a case bolted to the vertical motor frame.

These two significant applications typify the expert assistance which Westinghouse-Nuttall engineering can render in solving mechanical drive problems.

They are also an impressive indorsement of the qualifications of Westinghouse-Nuttall gearing to fulfill the difficult requirements of heavy-duty machine service.

Canadian Agents
Lyman Tube and Supply Company
Montreal, Toronto, Vancouver

WESTINGHOUSE ELECTRIC & MFG. CO.
NUTTALL WORKS PITTSBURGH, PA.
SALES OFFICES AND SERVICE SHOPS IN ALL PRINCIPAL CITIES OF THE UNITED STATES

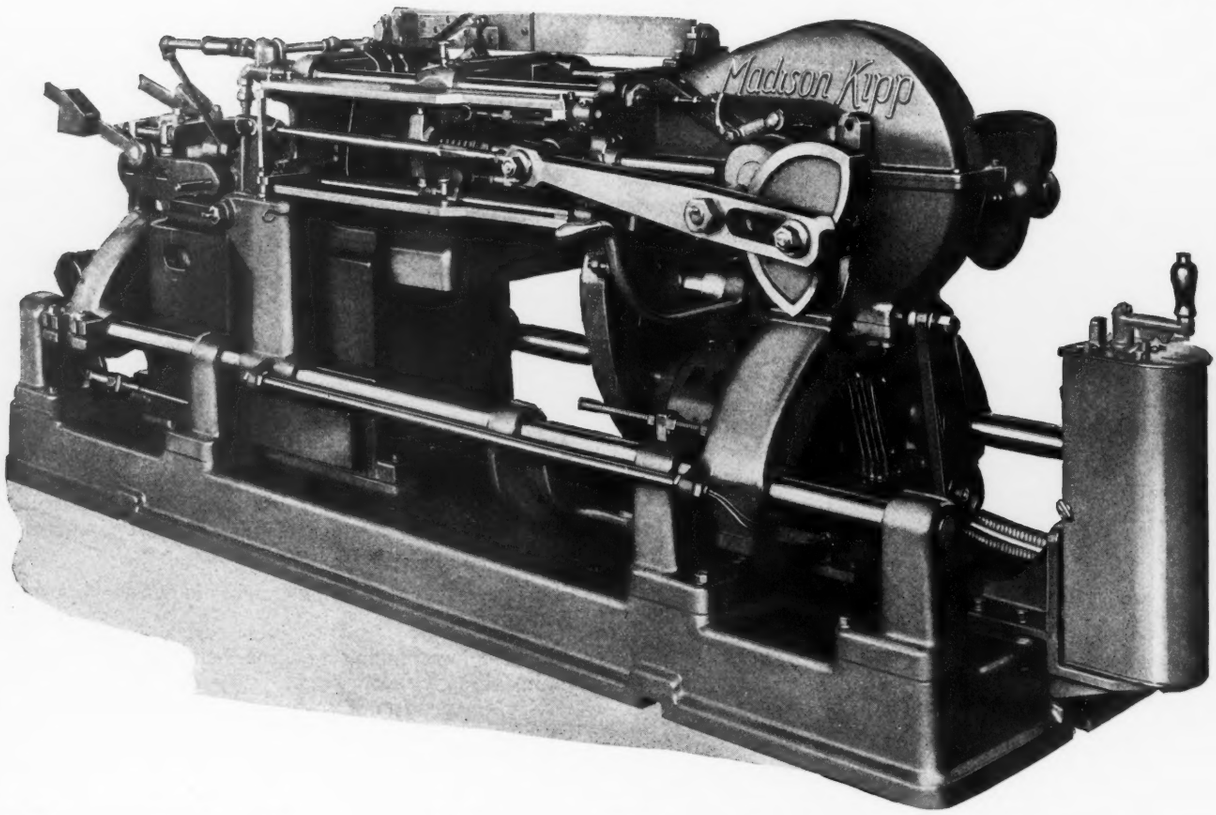
Westinghouse

T 30675

Industrial Apparatus includes - -

Arc-welding Equipment	Fuses	Panelboards
Automatic Switching	Instruments and Meters	Porcelain Insulators
Babbitt and Babbitt Pots	Insulating Materials	Safety Switches
Capacitors	Lighting Equipment	Stokers
Circuit-breakers	Mazda Lamps	Transformers
Electric Locomotives	Micarta Gears	Speed Reducers
Electric Ovens	Motors and Control	Furnaces and Ovens

Fully Automatic— for High Production



The Madison-Kipp Die Casting Machine

16-Cavity Die

Zinc Base Metal,
Weight per piece .65 ozs.

Machine Speed,
8 casts per minute

Piece Work Rate,
5760 Pieces per hr.

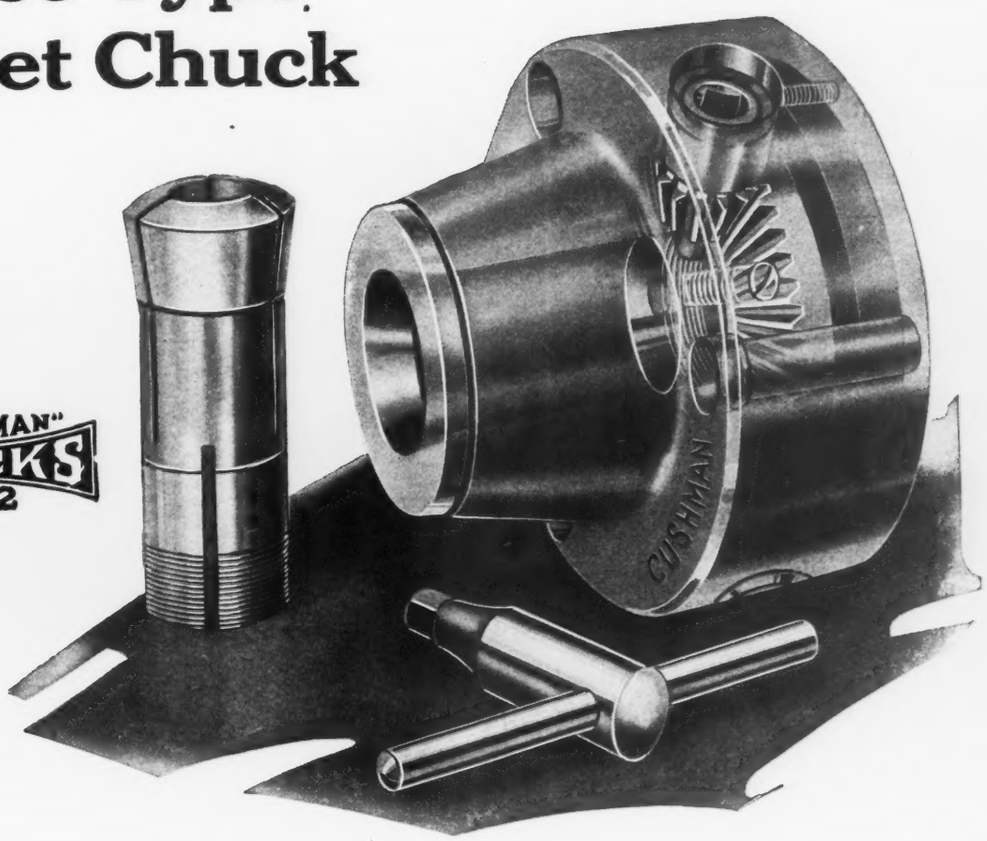
One Operator

The die here shown mounted on a Madison-Kipp Fully Automatic Die Casting Machine has sixteen cavities. It produces sixteen zinc base alloy parts that weigh .65 ounces each. It is operated at a machine speed of eight casts a minute. Allowing for all down time incidental to die casting work and operator's away-from-machine time, the piece work rate on this job over the past three years has been 5760 pieces an hour.

The Madison-Kipp is a modern machine tool for modern high production of die cast parts. We will gladly send complete information to any operating official, plant engineer, or executive interested.

Madison-Kipp Corporation, Madison, Wis., U. S. A.

A New Nose Type Collet Chuck



"CUSHMAN" CHUCKS 1862

Capacity for your large collets

You can hold large collets just as securely as small ones with the New No. 15 Cushman Nose Type Collet Chuck. Any bar ⅛″ to 1¾″ diameter that will pass through the lathe spindle can be accommodated.

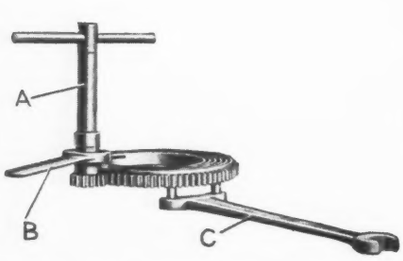
To insure long-sustained holding accuracy, extraordinary attention has been given to details of construction and design. Outstanding features of the No. 15 chuck include: one piece body ground both inside and out *after* hardening; high grade, heat-treated alloy steel discs and pinions; adequate bearing support for nose and back of chuck. Every feature contributes to economy and long life.

The special type collet used in the No. 15 can be obtained in any size from ½″ to 1¾″ inclusive, from our factory or from any distributor. Write us for details and prices.

THE CUSHMAN CHUCK CO.
HARTFORD, CONNECTICUT

CUSHMAN

The Chuck illustrated is a Westcott 4-Jaw Spur Geared Scroll Universal with Reversible Jaws.



The Spur Gear Construction—exclusive with Westcott—permits the operator to use any one of three methods for the Universal Movement of the jaws:

A, Key; B, Open End Wrench; C, Scroll Lever

No other chuck in the world possesses these time-saving features.

Make Westcott Your Next Chuck

Mill Supply Houses and special representatives in all parts of the United States carry Westcott Chucks in stock—or they can get them for you from factory stock immediately.

Westcott Chucks have served American Industry for three generations—always in step with the demands of progress. Today they are built better than ever.

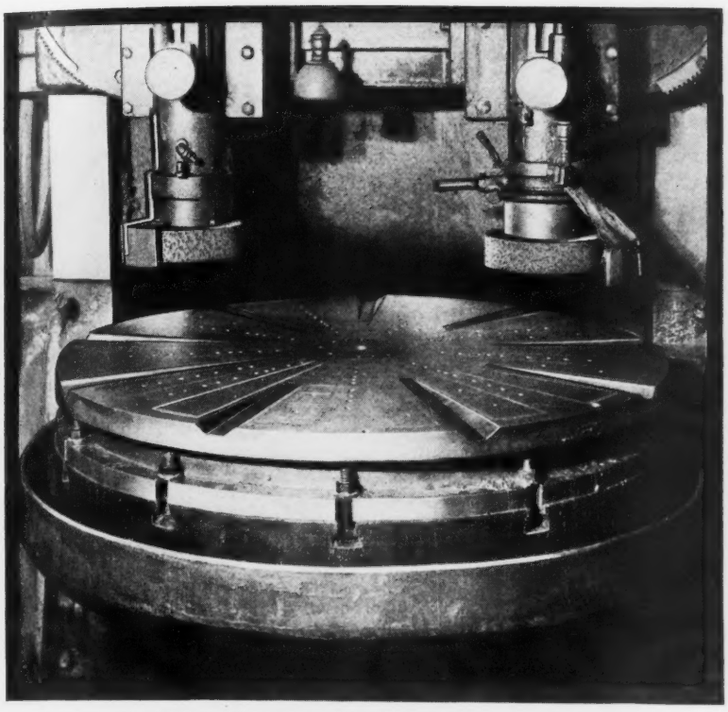
Bodies are of special semi-steel or cast steel; parts that are subject to wear are heat-treated. Westcott Chucks are carefully built to give long, hard service.

Ask your dealer for Westcott Chucks.

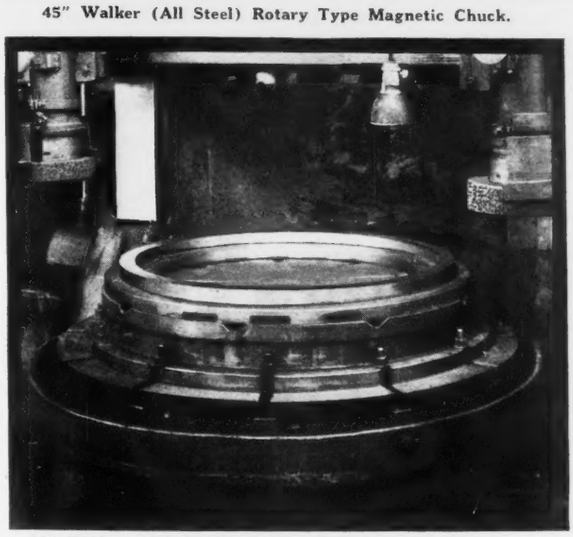
Send for Catalogue

WESTCOTT CHUCK CO., 116 East Walnut Street, ONEIDA, N. Y.

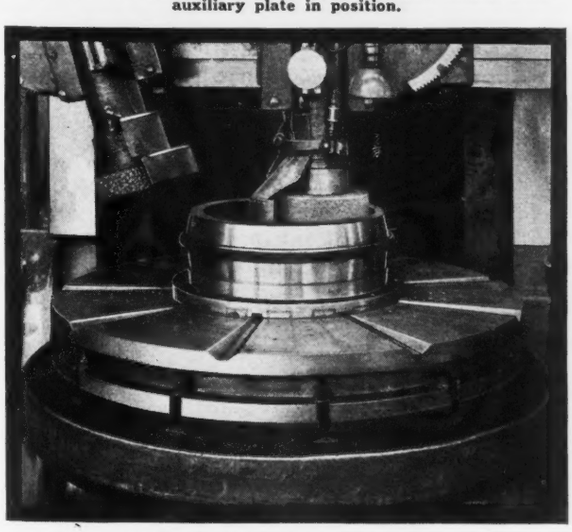
WESTCOTT CHUCKS



45" Walker (All Steel) Rotary Type Magnetic Chuck.



36" Walker (All Steel) Rotary Type Magnetic Chuck with auxiliary plate in position.



45" Walker (All Steel) Rotary Type Magnetic Chuck with small size auxiliary plate and work in process of grinding.

WALKER MAGNETIC CHUCKS

Hold Roller Bearing Races for Finish Grinding

Timken Quality — contributing to the efficiency of some of the world's finest machines—is the result of meticulous care in every step in the manufacture of Timken Roller Bearings.

This Walker Chucking installation is typical. The problem was—how to hold roller bearing races for finish grinding; it was solved by the use of special Springfield Grinders equipped with *Walker All Steel Rotary Magnetic Chucks* supplied with auxiliary grinding rings (furnished by us) in which the races—from 14 to 40 inches diameter—are set up in such manner that the grinding wheel can run off the cut and finish internal and external surfaces without leaving a shoulder.

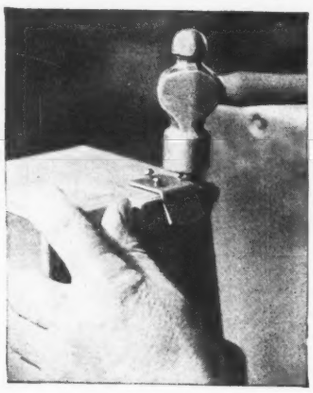
The difficulty of holding parts like these, the accuracy demanded in the finished product, makes this a typical "Walker problem" to be simply and profitably solved by Walker Engineers.

See Walker Chucks at Booth 2W8-A the N. M. T. B. A. in October; talk to Walker Engineers about *your* special chucking problems; in the meantime send for a catalog of Walker Magnetic Chucks—"the best way to hold most work, the only way to hold some of it."

O. S. WALKER CO., Inc.

Worcester, Mass.

ELIMINATE TAPPING WITH THESE UNIQUE SCREWS



Eliminated!

tapping . . crossed threads . . scrapped parts . .

by making fastenings with Hardened Metallic Drive Screws

Because they "lend themselves very readily to die castings and save a tapping operation," the Doehler Die Casting Co. uses Hardened Drive Screws for numerous vending machine assemblies.

As illustrated, these Screws are simply hammered into drilled or molded holes. No tapping necessary—the Screws cut their own thread, in the material. The elimination of a slow and costly tapping operation also abolishes stripped and crossed threads, the chief cause of scrapped parts.

More than 20,000 concerns in industry are making permanent fastenings easier, quicker, and cheaper with Hardened Drive Screws. For making secure fastenings to iron, brass and aluminum castings, steel, Bakelite, etc., these Screws offer many advantages over machine screws, escutcheon pins, and rivets.

Try Hardened Metallic Drive Screws—just describe your assemblies—we will send suitable samples.

PARKER-KALON CORP., 200 Varick St., New York, N.Y.

Distributed in Canada by
Aikenhead Hdw., Ltd., 19-21 Temperance St., Toronto

PARKER-KALON
TRADE MARK
HARDENED METALLIC
REG U S PAT OFF.
DRIVE SCREWS

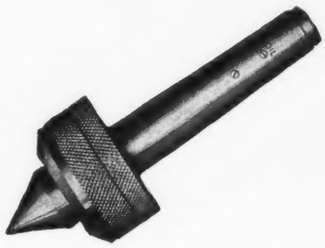
PAT. JAN. 29, 1924 No. 1482151 - OTHERS PENDING

For Making Fastenings to Iron, Brass and Aluminum Castings, Steel, Bakelite, etc.

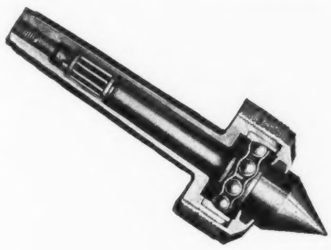
Use

NIELSEN

Live Centers



with



TUNGSTEN CARBIDE CUTTING TOOLS

At a demonstration of Tungsten Carbide Tools, held in Cleveland recently, a Nielsen No. 6 Center, taken from regular stock, showed its real merit.

The Center was subjected to two gruelling tests.

1st. A cut ⅝" deep with feed of .037" per Rev. was taken in cast iron. Cutting speed 500 ft. per minute. Length of cut 30".

2nd. Steel with an analysis of 0.50% Carbon, 0.75% Chromium, 1.5% Nickel was turned. A cut ¼" deep with a .037" feed per Rev. was taken. Cutting speed 200 ft. per minute. Length of cut 30".

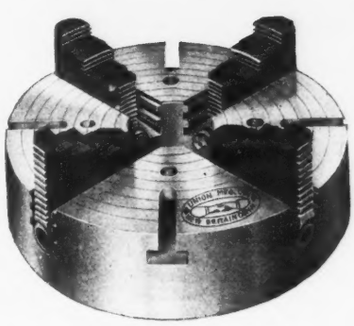
Despite the terrific strain the Center did not chatter, stick or burn. Nielsens are the Centers for your production work. Complete range of tapers. Send for handy table of dimensions and prices. Specials made to your drawings.

NIELSEN, Inc.
Lawton, Michigan, U. S. A.

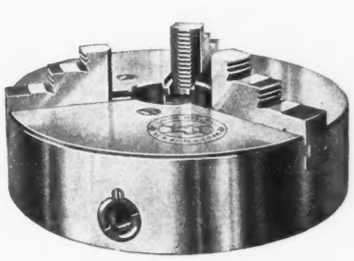
Hundreds of Thousands!

Yes, and Being Constantly Used

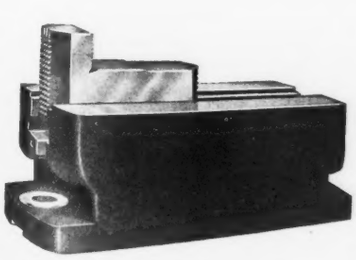
Union Chucks



No. 118 Iron Independent, 4 to 48 inches. No. 264 Steel Independent, 6 to 36 inches. 4 Jaws; chrome nickel screws. Hardened Jaws.



No. 153—Iron Geared Scroll Universal, 2 sets of Jaws 2½ to 30 inches. No. 123—Steel. Also furnished with Reversible Jaws or with either outside or inside jaws only.



Union Face Plate Jaws. No. 72—Steel 6 to 14 inches. No. 48—Iron 6 to 14 inches.

Two Ounces to Two Tons —Leaders for Fifty Years Keeping Pace with High Production Demands

Every Union Chuck is designed for efficiency and for quantity production.

Union Independent Iron and Steel Chucks have *Chrome Nickel Steel Heat Treated Screws.*

Union Combination Scroll or Independent Boring Mill Chucks 18 to 61 in.

Union Scroll and Combination Chucks are **self-centering.** Scrolls, Pinions and Jaws are heat treated for Long Service.

Union Chucks embrace the largest assortment made by any one manufacturer.

Union Chucks are rugged in construction and accurate.

Union facilities are at your service to help you with your chucking problems.

Write for No. 60 Chuck catalog.

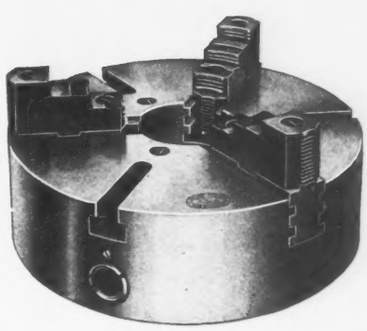
UNION MANUFACTURING COMPANY

Also Manufacturers of Union Spur Gear Army Type Hoists and Trolleys

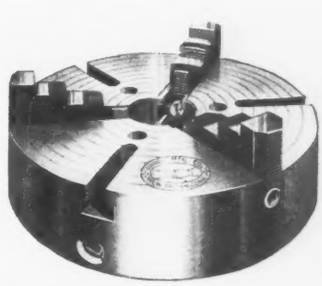
NEW BRITAIN, CONN., U. S. A.

Branch Offices and Stock

New York 26 Cortlandt St. | Chicago 27 So. Jefferson St. | Cincinnati 332 Sycamore St. | San Francisco 661 Folsom St.



No. 179 Iron Extra Heavy Geared Scroll Universal. No. S179 Steel, 4 to 32 inches with reversible jaws.



No. 183—Steel Geared Scroll Combination Chucks, 9 to 24 inches. No. 83—Iron, 4 to 24 inches. 383 Iron or S383 Steel with Reversible Jaws.

No. 60—Union Patent Ball Bearing Valve Chuck, 7 to 20 inches. Saves multiple handling of valves, angles, etc.

ITS USE

A good one for your driller, miller, shaper or planer.

The attachments mean that you can do much duplicate drilling without the cost of a jig.

Any vise will pay. More time is consumed in catching work than drilling it.

DRILL VISE

LIST (*Subject to Discount*)

No. 3, Jaws 6" long, Fig. 1, $45.00, Fig. 2, $40.00
No. 4, Jaws 9" long, " $60.00, " $54.00
No. 5, Jaws 12" long, " $85.00, " $75.00
V-Jaws extra. No. 3, $5.00; No. 4, $7.50; No. 5, $10.00 each. One V-Jaw is usually sufficient per vise.

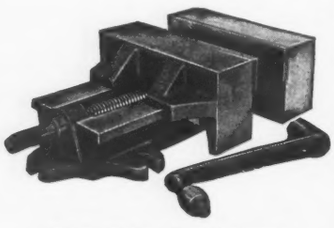


Fig. 2 Without Jig Attachments

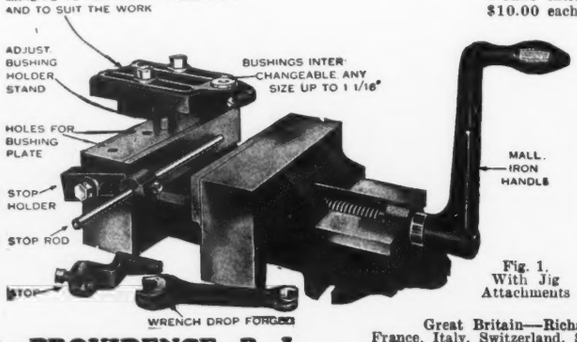

MOV. PLATE FOR SINGLE BUSHING MAKE PLATE FOR SEVERAL BUSHINGS AND TO SUIT THE WORK
ADJUST. BUSHING HOLDER STAND
BUSHINGS INTER-CHANGEABLE ANY SIZE UP TO 1 1/16"
HOLES FOR BUSHING PLATE
STOP HOLDER
STOP ROD
STOP
MALL. IRON HANDLE
WRENCH DROP FORGED

Fig. 1. With Jig Attachments

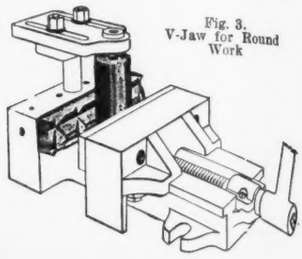


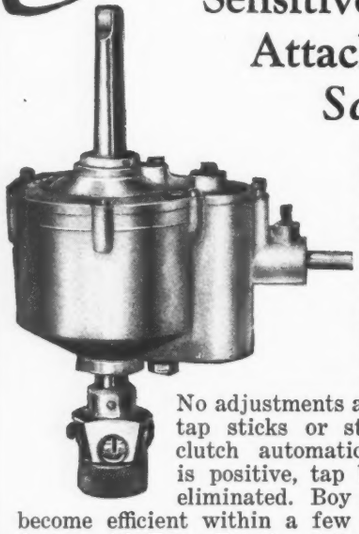
Fig. 3. V-Jaw for Round Work

THE GRAHAM MFG. CO., PROVIDENCE, R. I.

Great Britain—Richard Lloyd & Co., Ltd., Birmingham
France, Italy, Switzerland, Spain and Holland—Fenwick Freres & Co.
Germany—A. Kayser, Oranienstrasse, 126, Berlin

Ettco

High Speed Sensitive Tapping Attachments *Save!*



Hundreds of progressive manufacturers have standardized on Ettco Tapping Attachments. They're remarkably simple and more sensitive than your fingertips—you can actually *feel* the tap. No adjustments are required; when tap sticks or strikes bottom the clutch automatically slips—action is positive, tap breakage is really eliminated. Boy and girl operators become efficient within a few hours. You'll tap faster with Ettco Tapping Attachments—try one! *Ask for catalog.*

No. 1—Tapping attachment 3/16" in steel ¼" in C.I.... $35.00
No. 2—Tapping attachment 5/16" in steel ⅜" in C.I.... 50.00
No. 3—Tapping attachment ½" in steel ⅝" in C.I.... 80.00
Price includes Ettco Tap Chuck and 1, 2, 3 or 4 M.T. Shank

ETTCO TOOL CO., Inc.
590 Johnson Ave., BROOKLYN, N. Y.
Formerly
Tool Division of Eastern Tube & Tool Co., Inc.

SWEETLAND CHUCKS

BULLDOG GRIP

Shop men like Sweetland Chucks for their bulldog grip. They say—"If a Sweetland can't hold it, it can't be Chucked." The No. 5 Four-Jaw Independent Lathe Chuck shown has maximum strength with minimum weight. Good balance, hardened steel bearings, hardened steel reversible jaws and sturdy design insure long and efficient service

Catalog on request

The Hoggson & Pettis Mfg. Company
New Haven, Conn.

PROCUNIER

SAFETY TAPPING DEVICES
Quick Change Chucks and Collets
Stud Setters & Nut Setters
Don't hesitate to ask for a free trial
PROCUNIER SAFETY CHUCK COMPANY
18 S. Clinton Street, Chicago, Ill.

Casler Boring Heads

Bore on your milling machine with a Casler Boring Head. Save time, labor and tool costs. Send for descriptive bulletin.

HERMAN CASLER
CANASTOTA, N.Y.

Just Plug It In— *then demagnetize!*

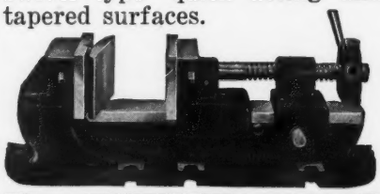
The new J & H Unipole Type Heavy Duty Demagnetizer is the last word in convenience and efficiency. Made to a new design that eliminates all belts, countershafts, etc., it plugs into any plug with alternating current and removes all residual magnetism from finished parts speedily and economically. A most practical tool that belongs in every shop.

Size 12" long by 9" deep, 6" high—35 lbs. weight. Supplied for 110 or 220 volt current. Send for one for a week's free trial.

J & H ELECTRIC CO., 200 Richmond St. PROVIDENCE, R. I.

Holds Odd-Shaped Work

Gem Drill Vises are made of a special alloy metal of marked tenacity, with deep jaws that give unusually ample gripping surface. One jaw is swivel type—quick acting and self-adjusting to tapered surfaces.



Three sizes, to jaws opening to 10½". Circulars and prices upon request.

J. E. Martin Tool & Die Works
548 West State Street
SPRINGFIELD, OHIO

GEM DRILL VISE

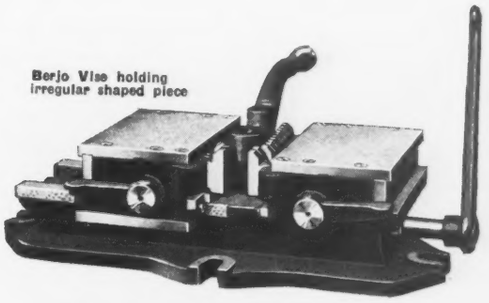
It Costs Less

Berjo Machine and Bench Vise

Special jigs and fixtures to hold work for milling, drilling or on the shaper, or for hand work on the bench, are frequently among the most expensive factors in production.

A Berjo Machine and Bench Vise *costs less* and holds the work as rigid as a special fixture. Its construction makes it immediately effective on regular and irregular work and as economical on short runs as on production operations.

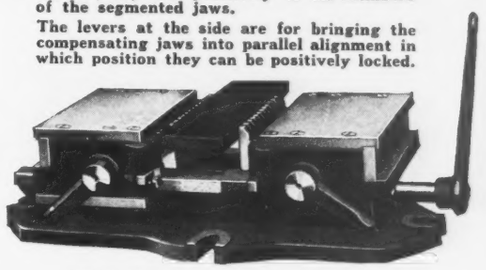
Berjo Vises save handling time, setting-up time; reduce equipment costs. *Send for details of Berjo Vises.*



Berjo Vise holding irregular shaped piece

The large lever at the end delivers the pressure equally and positively to all members of the segmented jaws.

The levers at the side are for bringing the compensating jaws into parallel alignment in which position they can be positively locked.



Berjo Vise holding a regular shaped piece.

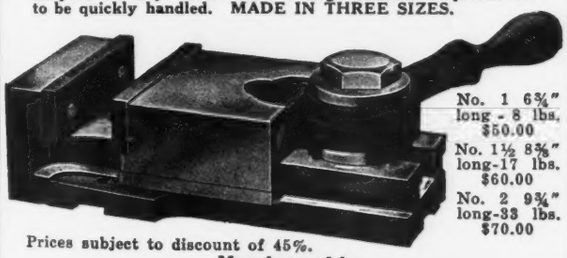
Manufactured by the Makers of Avey Drilling Equipment.

Patents Pending under exclusive license.

THE AVEY DRILLING MACHINE COMPANY, Inc.
CINCINNATI, OHIO

The Pronto Quick Operating and Wide Opening Lever Vises

Designed for Milling and Drilling Machines and are specially adapted for any work where a large number of pieces are to be quickly handled. MADE IN THREE SIZES.



No. 1 6¾" long - 8 lbs. $50.00
No. 1½ 8⅜" long-17 lbs. $60.00
No. 2 9¾" long-33 lbs. $70.00

Prices subject to discount of 45%.

Manufactured by
EDW. PURVIS & SON
110 YORK ST. Successors to Carter & Hakes BROOKLYN, N. Y.

Out of This We Made This

BEFORE AFTER

RECUT WITHOUT ANNEALING or altering the original temper. Spirals, side mills, plain mills, end mills and metal saws made as good as new. Send a trial order and let us demonstrate.

We recut old files as good as new

CHICAGO TOOL RECLAIMING COMPANY
162 West Austin Avenue CHICAGO, ILL., U. S. A.

Twisting Jobs won't slip

the REED'S jaws grip *tight*

Holding onto a twisting job with a bulldog grip is another thing that the REED Vise is noted for.

The proper weight is distributed in the body members, making the REED jaws rigid. The full force of any blow or effort reaches the object in the vise.

Let us tell you of other points you'll like about this rigidly built Vise.

Reed Manufacturing Company
Erie, Pa.

REED Vises, Stocks, Dies, Etc.

CARD QUALITY TAPS

Tapping—like other modern production operations—is a double problem of machine and tools.

Card Taps on modern, correctly balanced, smooth running tappers give threading results that increase manufacturing profits.

Card Cut Thread Taps for usual tapping operations, Card Ground Thread Taps where super accuracy is essential, leave nothing to be desired as threading tools for the best tapping machines.

Fifty-five years devoted to tap design and production have developed the Card line and a tradition of service that insures correct quality and design in every tool; production facilities in a modern plant enable us to guarantee speedy deliveries to **dealers and users.**

Catalog No. 32 lists the Card Quality Line; may we send it?

1874 The CARD Quality **1929**

S. W. CARD MANUFACTURING CO.

MANSFIELD Division of Union Twist Drill Co. **MASS., U.S.A.**

Red-E Holders

for Tungsten Carbide Tools

Modern Tungsten Carbide Tool Bits, Stellite and High Speed Steel Cutters operate with greatest efficiency in Red-E Tool Holders—a special hardened tool steel bearing in the holder provides ample support, prevents tool breakage and lowers tool costs. Try Red-E Tool Holders for economy.

Catalog 21 for complete line

RED-E-TOOLS

The Ready Tool Co.

550 Iranistan Ave., Bridgeport, Conn.

Detroit Branch: 2970 West Grand Boulevard

Devices That Save Their Cost

on the first job and increase operating convenience and production profits for a long time thereafter are worth investigating.

Nicholson Expanding Mandrels

are in this class. Sizes for work from ½" to 7" diameter; No. 4 (shown) fits bores from 2" to 2½". Try a set in your plant. Send for a price list.

W. H. NICHOLSON & COMPANY

112 OREGON STREET WILKES-BARRE, PA.

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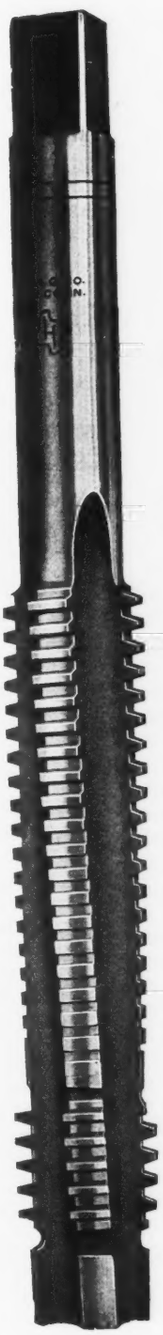
"RIGHT TO THE POINT"

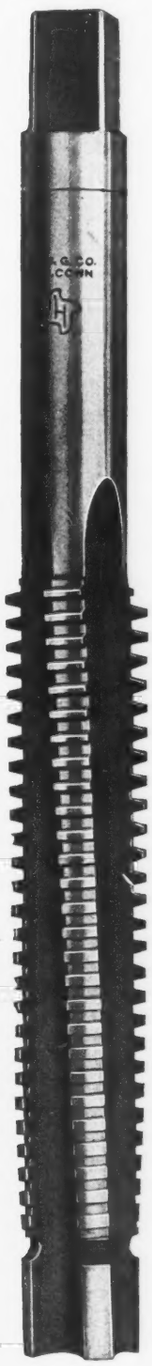
High Speed Twist Drills and Reamers

Increasing numbers of Tool Superintendents and Production Managers are finding Ampco's specialized production of high speed steel tools a real aid in meeting the demands of intensive production schedules. Standard and special tools made to specification are illustrated in Catalog No. 6. Send for your copy.

AMPCO TWIST DRILL CO., Jackson, Michigan

Branches in all principal cities—see telephone directories





"HANSON" PROCESS

As Fine as a Toledo Blade

Who has not heard of the swords of Toledo and of the infinite care and skill with which their supple blades were fashioned from the finest steels.

Many of the same qualities which made the products of old Toledo world famous are found in Hanson-Whitney Precision Taps. The best steels known are employed after careful selection, inspection and approval by a staff of trained experts. In the hands of skilled workmen these finest of wear-resisting materials never lose their original perfection as they pass through the hardening and finishing processes—H-W Taps are finished *after* hardening, thus eliminating any defects which might result from heat-treating.

Tough, never brittle, Hanson-Whitney Taps deliver many hours of extra service between grinds—extra service that thrusts straight at the heart of costs. Standardize on H-W Precision Taps and you can depend on superior, lower-cost-per-hole threading. Write for details.

THE HANSON-WHITNEY MACHINE CO.

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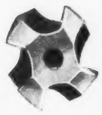
Eclipse Two Piece Core Drills

Production tools for enlarging and boring holes from 1¾" diameter up, in castings and forgings. Made to *your specifications* for *diameters and lengths* with Morse Taper, Magic or straight shanks with deep fluting for chip clearance and rugged square taper drive.



Eclipse Two Piece Core Drills are giving profitable service in automotive and industrial plants where production efficiency demands the best tools.

ECLIPSE INTERCHANGEABLE COUNTERBORE COMPANY

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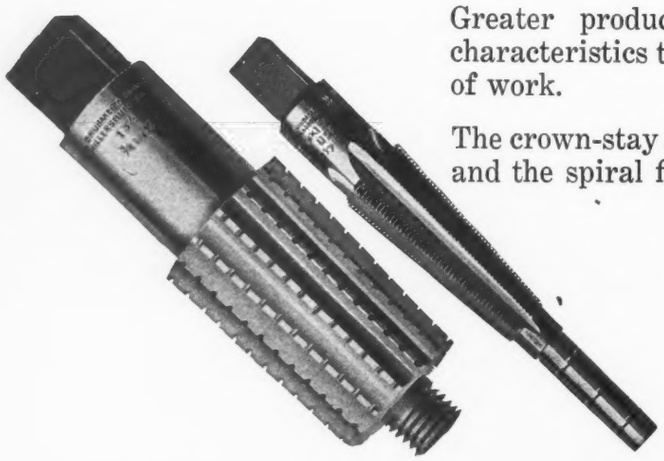
San Francisco
Cleveland
Dayton
Philadelphia
Milwaukee
Pittsburgh

Factory and General Offices
DETROIT

Chicago
Los Angeles
Cincinnati
Buffalo
Syracuse
Toronto
Boston

Send for the Eclipse Catalog of production tools.

More Work per Tool—



Greater production, greater durability are Brubaker characteristics that increase production profits on all kinds of work.

The crown-stay locomotive tap, the flexible staybolt reamer, and the spiral fluted staybolt tap shown are only three of the line of Brubaker Tools showing high standards of efficiency in railroad shop service.

The Brubaker Line includes taps, dies, reamers for all classes of work; Brubaker experts will design special tools to meet special needs. Send for details and prices.

SPIRAL FLUTED
STAYBOLT TAPS
REAMERS
TAPS
DIES
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STRAIGHT AND TAPER
INSERTED BLADE REAMERS

W.L. BRUBAKER & BROS. CO.

FACTORY, MILLERSBURG, PA.

Sales Office: 50 Church St., New York

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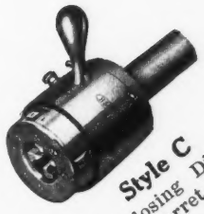
DIE HEADS

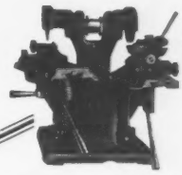


Style C
Hand closing Die Head for hand turret machines.

Style D
Head for Brown & Sharpe Automatics and other small machines.

Style EE
(ROTARY)
Designed for automatics such as Gridley, National, Acme, New Britain, Cone, Cleveland multiple and for threading machines and bolt cutters, where the die head rotates.

Threading Machine



Chaser Grinder

Sizes and Styles for All Machines

All Styles of H & G Die Heads Use the Same Chasers

THREADING ON AUTOMATICS

If you are using *old* die heads or solid dies on your automatics that are difficult to adjust or that are continually causing shutdowns, install H & G Style EE Heads on your rotary spindles.

If you *are not* threading on automatics because of unsatisfactory results, install H & G Die Heads and save the costs of rehandling and extra operations.

THREADING ON B & S AUTOMATICS

If your Brown & Sharpe Automatics are still using *solid* dies, why not install H & G Style D Heads and learn the new production speeds possible from high speed hobbed chasers that cut accurate threads and eliminate reversal of spindle?

THREADING ON TURRET MACHINES

On hand turret machines, H & G Style C Heads will permit higher speeds with thread quality unsurpassed.

H & G THREADING MACHINE

The H & G Threader for second operation threading will usually pay for itself in less than a year. If you are using a large cumbersome machine that takes up considerable floor space, and that is difficult to change from one job to another; or where considerable time is lost in removing chasers or adjusting to size and length, you are wasting time, space and money. The H & G Threading Machine uses floor space of only three feet by one and one-half feet. It is extremely fast and can be operated and adjusted by almost anyone.

H & G CHASER GRINDER

If you are still grinding chasers by *hand*, you are not getting the uniformity of product or as long a chaser life as you are entitled to.

SEND FOR NEW H & G CATALOG

Famous for Accuracy, Long Life, and Dependability

THE EASTERN MACHINE SCREW CORPORATION

NEW HAVEN, CONNECTICUT

Colton-Detroit Drills

Use Them for Your Hard Drilling

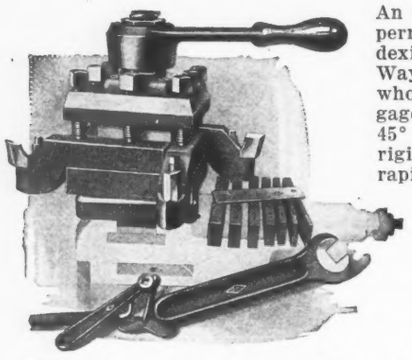
Colton - Detroit Drills represent the highest achievement in drill design and manufacture for high speed operation and to produce the largest number of holes between point grinds — there are none finer.

Send for catalog showing complete line of standard Wire, Letter, Jobber, Straight and Taper Shank High Speed Drills, Oil Hole Drills, Gun Drills, Concave Bakelite and Black Devil; also special drills to meet your requirements.

ARTHUR COLTON CO. 2618 Jefferson Ave., E. DETROIT, MICH.

REPRESENTATIVES: **New York City:** F. A. Brady, Inc., 30 Church St. **Milwaukee:** General Sales Agency, 3025 Vine St. **Pittsburgh:** W. A. Holsberg, 6723 McPherson Blvd. **Philadelphia:** Wenson Tool Co., 745 North Sixty-third St. **San Francisco:** L. G. Henes, 75 Fremont St. **Los Angeles:** L. G. Henes Mchry. Co., 1500 Santa Fe Ave. **Cincinnati:** Smith-Bingham Co., 1012 Elm St. **Syracuse:** Wm. G. Harvey, 420 First Trust & Deposit Bldg. **Atlanta, Ga.:** J. R. Walraven, 205 Forsyth Bldg.

Greater Indexing Accuracy with An OK Four Way Tool Post



An exclusive OK feature permits more accurate indexing with OK Four Way Tool Posts. The whole square bottom engages a bottom plate at a 45° angle, providing the rigidity necessary for rapid, accurate indexing.

Design of the OK Tool Post provides sufficient drop to bring cutting edge of tool in center of lathe, and with many other features, speeds up lathe operation and substantially reduces tool and labor costs.

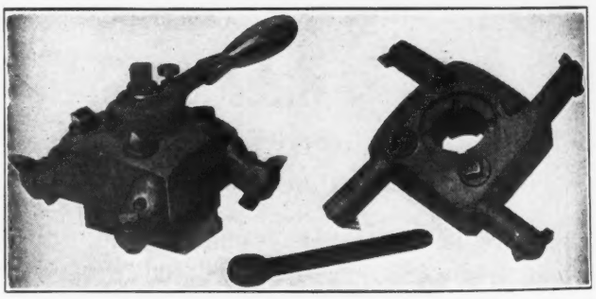
Carefully hardened, special alloy steel, machined all over, makes OK Posts strong and durable. Write for details.

"Our Service Department is at your Command."

THE TRADE OK MARK TOOL CO., INC.

Shelton, Conn.

O.K. **Tools for LATHES, SHAPERS, PLANERS, BORING MILLS, AUTOMATICS, SPECIAL MACHINES, MILLING MACHINES**



Save Time

The Lovejoy Turret Tool Post for Engine Lathes holds four tools, securely locked against movement by the original Lovejoy method. With one hand, a turn brings each into position—accurately indexed for the next cut. A clear saving of the time needed to reset the cutters. Many combinations are possible with easily interchangeable rings.

Let us send further information on this profitable time saver, and also a convenient form for ordering.

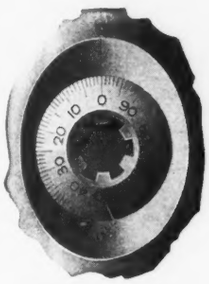
THE LOVEJOY TOOL CO., Inc.

SPRINGFIELD, VT.

METAL CUTTING TOOLS

To REDUCE COSTS and INCREASE PRODUCTION use

Improved Type "L" Davis Expansion Boring Tools



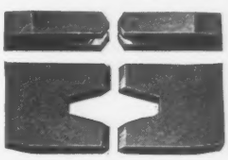
MICROMETER ADJUSTMENT

This tool solves the problem of increasing production and reducing cost. Rigid construction, simplicity of design and operation permit with safety the increase of speeds and feeds, which guarantee greater production on a definite schedule with absolute accuracy.

The micrometer adjustment for expanding the cutters to bore any size required or to compensate for wear will enable you to bore odd or standard sizes.

Standard Piloted Turret Lathe Tool, Style E. Has hardened and ground pilot. Can be furnished without pilot or in any other design to suit your boring machines.

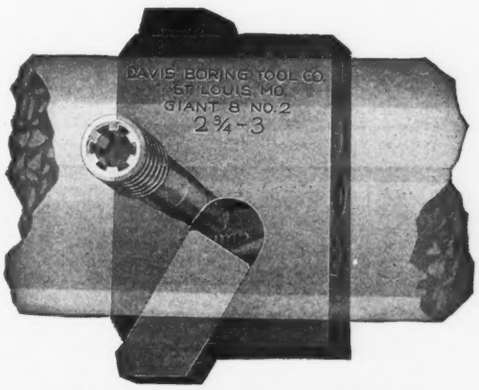
WEDGE BEARING



EXTRA CUTTERS

Carried in stock for immediate delivery; furnished with a guarantee to bore more holes per grind than any other cutter.

For Complete Information, Write for New Circular L-1

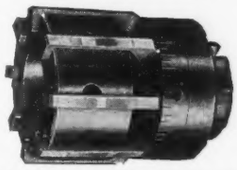


DAVIS EXPANDING BLOCKS

Have distinctive features and are suitable for either rough, semi-finish, or finish boring operations, sizes 3/4" to 18 1/4" diameter.

Where a floating reamer is required, the Davis Expanding Block may be used as a floating unit to compensate for errors of non-alignment in machine set-up, accurately finishing a hole that has been previously bored within .006 to .010 of final size.

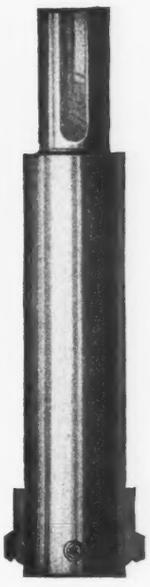
For Complete Information, Write for Block Circular



DAVIS EXPANSION REAMERS

represent the highest development in reamer construction, and yet are comparatively simple in every detail. They have maximum expansion and are furnished in all styles.

Write for Reamer Circular giving full description



Standard Stub Bar for Turret Lathe. Can be furnished with hardened pilot or any other design to suit your boring machines. Specially suitable for line bars on horizontal boring mills.

Complete Units of Expansion Boring Tools and Reamers

1. Davis Type "L" Expansion Boring Tools for rigid boring.
2. Davis Block Type Expansion Boring Tools, for rigid boring and float reaming.
3. Davis Expansion Multiple Blade Reamers, all styles.
4. Davis Expansion Multiple Cutter Boring Heads.
5. Special Tools and Cutters furnished in any design for any machine that bores.

DAVIS BORING TOOL CO., Inc.
Division LARKIN PACKER CO.
6200 MAPLE AVE.
ST. LOUIS, MO.

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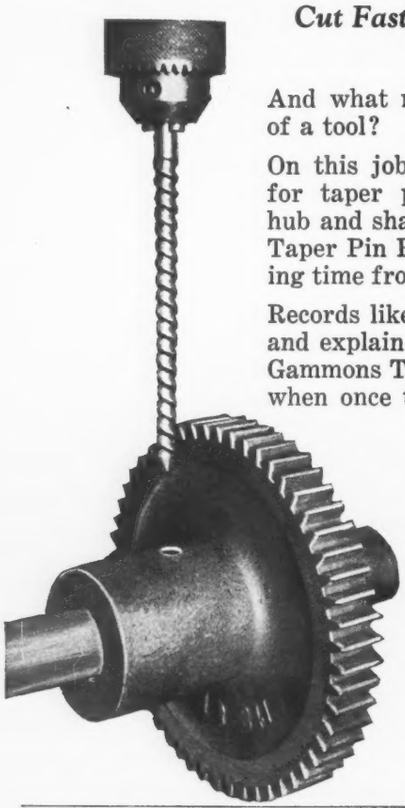
Better Work and More of It With Madison Boring Bars

A production increase of 400% sounds pretty big—but it's no rarity when ordinary boring bars are replaced by Madison equipment. The secret is in the elimination of overheating, permitting production boring tools to keep consistently at top speeds. Never distort, produce cleaner and more accurate holes in any metal, adjustable to .00025". Floating cutters compensate for misalignments.

Full details on request

MADISON MFG. CO.
Muskegon, Michigan

GAMMONS TAPER PIN REAMERS



Cut Faster—
Last Longer

And what more can you ask of a tool?

On this job—reaming a hole for taper pin through gear hub and shaft—the Gammons Taper Pin Reamer cuts reaming time from 20 to 2 minutes.

Records like this are common and explain the popularity of Gammons Taper Pin Reamers when once tried.

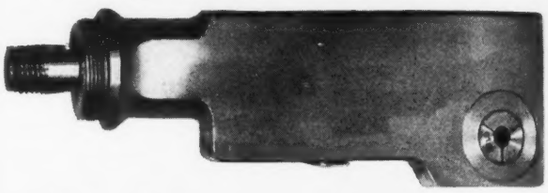
Send for details and prices.

THE GAMMONS-HOLMAN CO.
Dept. M.
MANCHESTER, CONN.

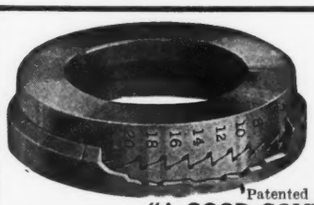
For Those Hard-to-Get-At Places

Drilling--Grinding--Keywaying--Countersinking

Use The Midget Right Angle Drill. With or Without Flexible Shaft. From 0" to ¼". Works in ½" corners, ¾" spaces.



Charles A. Koza, 464 Augustine St., Rochester, N. Y.



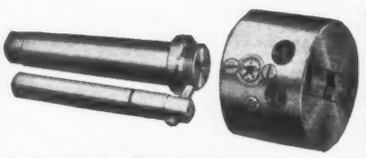
"Scully-Jones" Adjustable Spacing Collar
For Milling Machine Arbors
Hardened and Ground
SAVE SET-UP TIME
Patented
"A GOOD COMBINATION"
HARDENED and GROUND SOLID SPACING COLLARS

Ends are ground parallel, lengths are accurate

Made of Machinery Steel Regularly furnished with new standard keyways

All thicknesses and standard arbors carried in stock for immediate delivery
SCULLY-JONES & CO., Tool Division
1901-09 So. Rockwell St., Chicago, Ill.

For Economy in Precision Boring



Flynn Micrometer Off-Set Boring Heads

A mechanically-perfect precision head of simple design and few parts.

All parts of heat-treated nickel steel.

This compact head has the least overhang of any head on the market, yielding utmost rigidity, and maximum table travel.

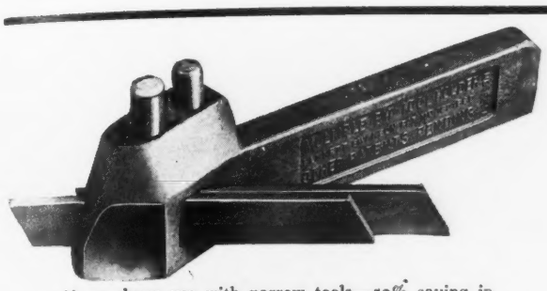
Made in a full range of sizes to fit all standard spindles and arbors. Send for descriptive bulletin and price list.

J. M. WATERSTON 423 Woodward Ave. DETROIT, MICH.

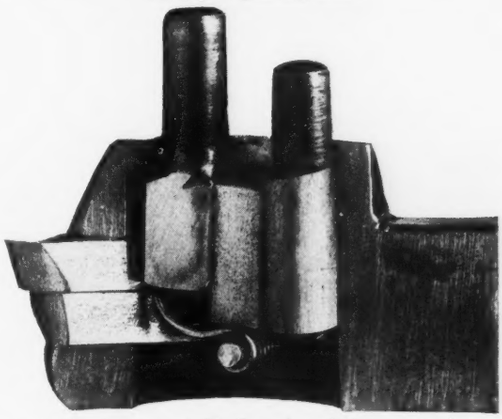
Get Acquainted!
IT WILL PAY YOU!
Aulenback Wrenchless Tools
18 Grafton Street WORCESTER, MASS.

SPECIAL
and Standard, Milling Cutters, Saws, Gear Cutters, Rotary Knives, Solid Type Reamers and Special Tools.

COWLES TOOL COMPANY, Cleveland, Ohio
TOOL MANUFACTURERS



Above shows use with narrow tools—50% saving in steel, plus grinding cost.



Application as specifically adapted for supporting Tungsten Carbide bits.

WEDGE-LOCK

The Multiple Bit Tool Holder

1—Saves Time—rapid change of tool bits without removing holder or backing away from work.

2—Saves Labor—50 to 75 per cent grinding time. (Smaller bits require less grinding.)

3—Increases Production—fewer shutdowns for changing or grinding tools.

4—Saves at least 50 to 75 per cent of Tool Bits. (Can use smaller size.)

5—Eliminates breakage where STELLITE, TUNGSTEN-CARBIDE or similar ultra hard metals are used.

6—Holds tool bits ABSOLUTELY RIGID.

7—Prevents side play.

Send for details of Wedge-Lock Tool Holders and a circular with interesting application photographs

WEDGE-LOCK TOOL COMPANY

Factory Branch: 2523 N. Keeler Ave., Chicago, Illinois

549 West Randolph Street, CHICAGO, ILLINOIS

UNBRAKO

Sockethead Cap and Hollow Set

SCREWS

"UNBRAKO" Screws are famous for their unusually accurate and clean threads. The **"UNBRAKO"** won't fracture, won't round in the hex, won't mushroom.

A complete line always in stock. Write us for free samples and Form 398.

Standard Pressed Steel Co.
Box 22 Jenkintown, Pa.

Taps and Dies

MURCHEY

A complete line of high grade Collapsible Taps and Self-Opening Die Heads. Write for details.

MURCHEY MACHINE & TOOL CO.
951 Porter St., Detroit, Michigan

"Red Shield" High Speed Drills

ALL SIZES

THE STANDARD TOOL CO.

NEW YORK CLEVELAND CHICAGO

Another Good Drill Gone Wrong

It was a good drill. Tough as the Celfor hot-twisting forged process could make it. Too bad it was repointed improperly. Even the best drill (Celfor) is hardly proof against excessive thinning and too much clearance.

We not only furnish this superior grade drill but also tell you how they can be pointed for long continued use. Send today for latest catalog.

CLARK EQUIPMENT COMPANY
Buchanan, Michigan

CELFOR

a NECESSITY when Using the New TUNGSTEN CARBIDE TOOLS

The "ROTO"

LIVE CENTER

Obtain Maximum Efficiency From Machine Tool and Cutting Tools

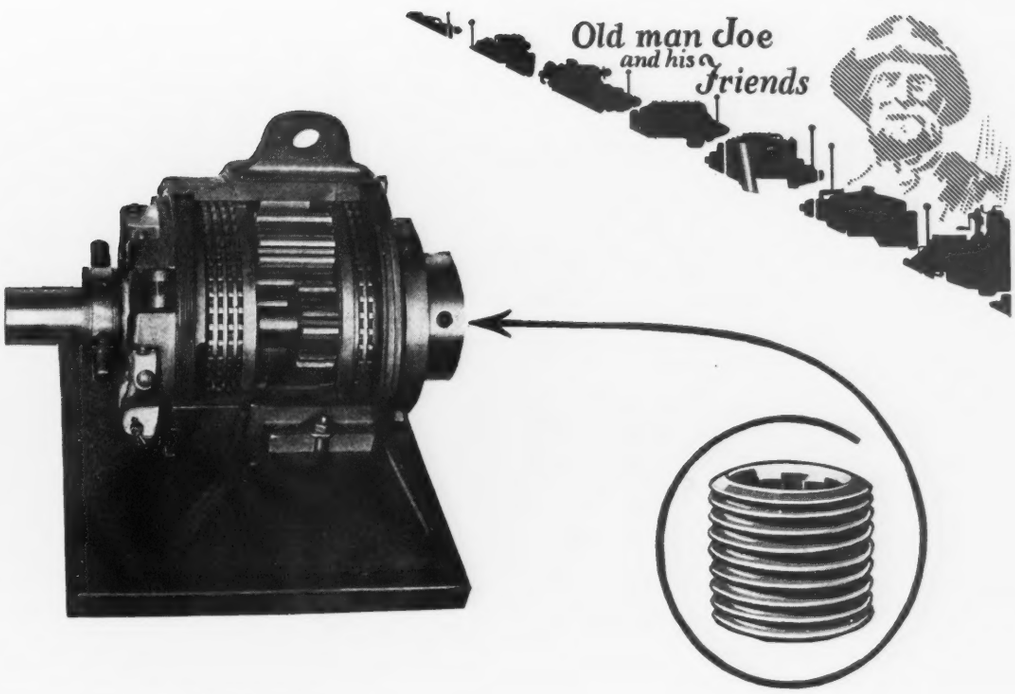
To avail themselves of the increased productive capacity, progressive manufacturers are adopting Carboloy, Widia, and other new metals for their cutting tools. This means that center troubles are immediately encountered. Owing to the higher cutting speeds attained, dead centers burn up because of the increased friction caused by the high generation of heat and expansion, necessitating the use of centers equipped with anti-friction bearings. It was with these revolutionized machining operations in mind that the ROTO LIVE CENTER was designed. Its rotating principle and mechanical perfection eliminate all difficulties. Exhaustive tests have proved its accurate endurance.

It is to your interest to investigate. Write today.

Q-C ENGINEERING & TOOL SALES, Inc.

STANDARDIZED TOOL DIVISION

7 EAST GRAND AVE., DETROIT, MICH.



OLD MAN JOE says:

"We have been using Bristo Safety Set Screws in our reversing gears for a number of years and have found them satisfactory in every respect."

Joe's Gears are standard equipment on forty-eight leading marine engines, and hold an unrivaled position in this field. Joe's Gears helped to translate the power of Gar Wood's Miss America VII into a world's speed record of 93.123 M.P.H. at Miami Beach.

Therefore this comment of Old Man Joe, on the value of Bristo Safety Set Screws, is particularly impressive, for it is certain that these set screws are helping Joe's Gears to maintain their leadership.

Perhaps they can do the same for you!

Bristo Safety Set Screws have a patented dovetailed socket that gives the wrench a perfect grip. Great pressure tends to contract instead of spread the socket. It will not round out or split.

This positive grip means that Bristos can be set tighter, and loosened more quickly, than any other set screw.

In spite of their unique design, efficiency, and extra long life, Bristo Safety Set Screws cost less than many other safety set screws.

We will be glad to send sample screws in your sizes for any tests you might wish to make.

BRISTO

SAFETY SET SCREWS

THE BRISTOL CO., WATERBURY, CONN.

DEPT. E.

"Retain keenest edges 25 to 30% longer..."

Says M. E. Hunt, Foreman of Tool Room and Experimental Dept. Caille Motor Co., Detroit, makers of outboard motors.

Many users tell of the longer life and consequent economy of American Swiss Files of Precision. It is gratifying that so many of them are enthusiastic enough, not only to tell us this, but to allow their names to be used as well.

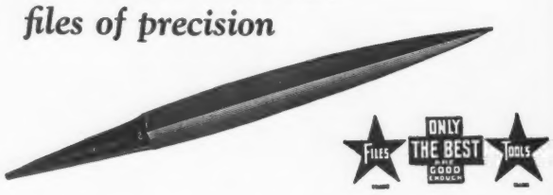
"For wearing qualities, we find American Swiss Files outlast others considerably," write the Detroit Vapor Stove Company. "In our opinion, they are superior to any other so-called Swiss Pattern file," write the Stromberg-Carlson Tel. Mfg. Co. "Longer life than any file we have tried," write the Zenith-Detroit Corporation.

You need not, however, be satisfied with this evidence. Make your own tests. See for yourself that American Swiss Precision Files do last longer. Send for our file handbook listing 2400 different sizes, shapes and cuts to choose from; from it select the file you want to use for your test and send us a trial order.

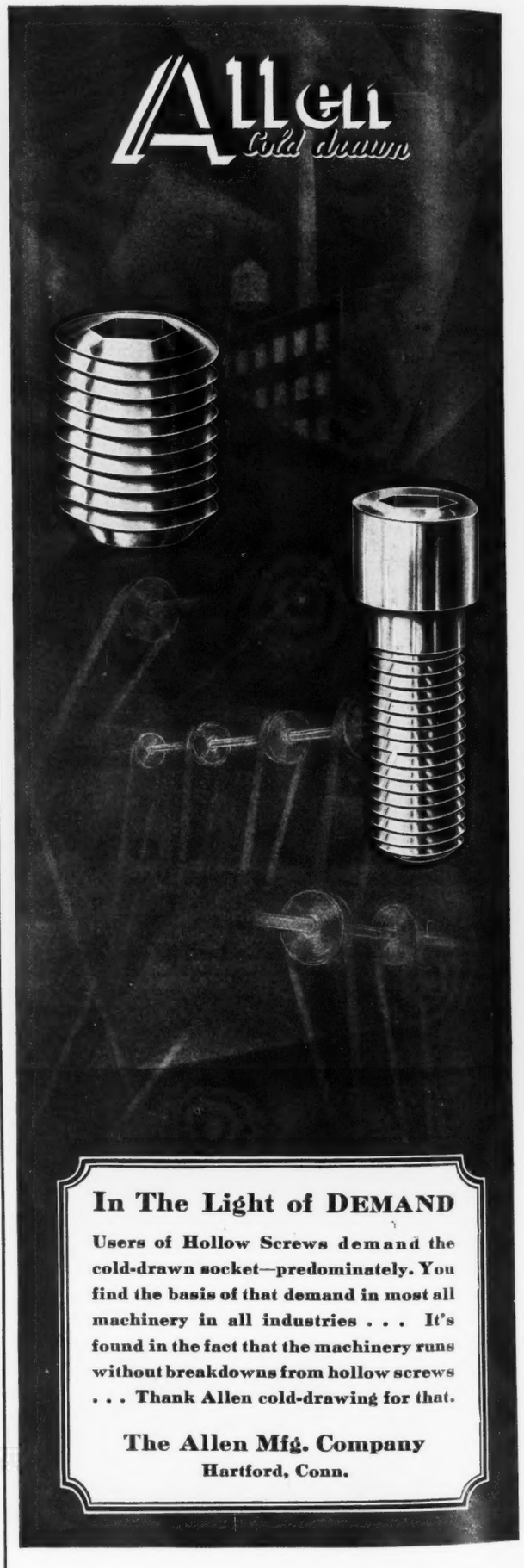
Also manufacturers of American Swiss Quality Mechanics' Hand Tools and Knurls. Send for our catalog.

American Swiss File & Tool Co.
410-416 Trumbull St. Elizabeth, N. J.

American Swiss
files of precision



Note: A separate department is now maintained by this company for the manufacture of knurls and mechanics' hand tools. The same American Swiss quality and workmanship that characterize the files, will be found in these new products. Write for catalogs.



In The Light of DEMAND

Users of Hollow Screws demand the cold-drawn socket—predominately. You find the basis of that demand in most all machinery in all industries . . . It's found in the fact that the machinery runs without breakdowns from hollow screws . . . Thank Allen cold-drawing for that.

The Allen Mfg. Company
Hartford, Conn.

Yoder depends on *Mac-its*

HERE is a test even for the mighty strength of a *Mac-it* Set Screw—holding down the bearings of the rolls on this Yoder cold roll forming machine. All the pressure exerted on the metal being formed must be endured by the *Mac-its* on the job—and *Mac-its* have long since been decided upon as standard parts because of their ability to stand up without noticeable wear and without damage.

Even under such severe use, *Mac-its* do not have to be replaced. They will not mushroom at the point, break, or become distorted with long use. A *Mac-it* is made that way. It has no counterpart for actual worth. Ask for price list, and samples.

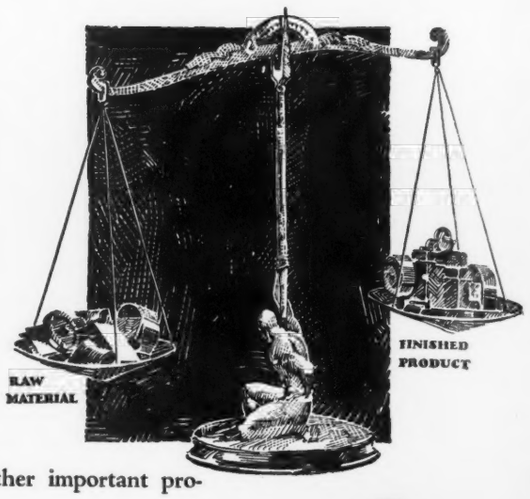
Mac-it Cap Screws are made in Socket, Fillister, Button, Flat, Round, Hexagon and SAE Hexagon Head in a full list of sizes. Price List and samples on request.

STRONG CARLISLE & HAMMOND

Mac-it Set Screws are made in Hollow, Square-Head, Tool Post, Mining Machine, Railroad Eccentric and Slotted Headless types in a full list of sizes. Ask for Catalog.

1392 WEST THIRD STREET, CLEVELAND, OHIO

What Should The Balance Be?



Productimeters recording daily volume on important production machines tell you quickly and plainly what these machines are doing. They make it easy to figure exactly the ratio of raw material to finished product, determine costs, discover faulty or underproductive units, estimate material and labor requirements and other important production control data.

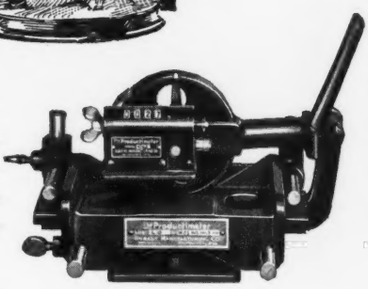
Available in a size and style for every counting purpose—to record operations, to "tally" large and small units and parts entering into, going through, or coming out of any production or handling process. We have made counting machines for fifty years; our specialized experience is at your service.

Durant Mfg. Co., 615 Buffum St., Milwaukee, Wis.

Established 1879

Representatives in Principal Cities

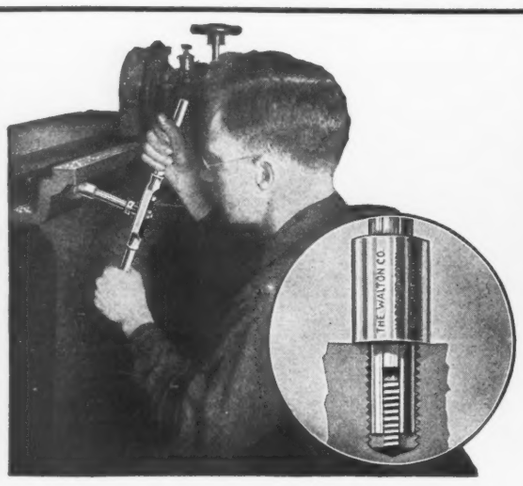
Productimeter 5-B7 for application where the count of revolving motion is desired. Furnished in 5 or 6 figure resetting, one count per revolution of shaft. Rotation either direction.



Productimeter L-10 Lineal Measuring Machine. For direct application to production machine or for mounting and operating independently on stand or table. Records in feet. On special order can be furnished to record in yards or meters.

Productimeters

THE SPEEDOMETERS OF INDUSTRY



Eliminate the Broken Tap Bugaboo

How many times has a broken tap spoiled a thread, held up production, or ruined a job in your plant? How long does it take to remove a broken tap with a cold chisel?

Walton Tap Extractors work in a jiffy, never fail, and always save the thread. No shop can afford to be without them — and they cost so little every shop can afford them.

Try a Walton on 60 days' trial. Just tell us the size of taps used.

THE WALTON COMPANY

310 Pearl Street **Hartford, Conn.**

Write for bulletins

OSGOOD'S

Diamond Tools and File Accessories

HIGH-GRADE DIAMOND TOOLS for dressing emery wheels and general purposes.

OSGOOD FILEGRIPS—soft pliable rubber tips — protect hands and afford better grip.

OSGOOD INDESTRUCTIBLE FILE HANDLES—steel inner tubes prevent splitting and splintering—can't loosen.

J. L. Osgood Machinery & Tool Company, Inc.

43-45 Pearl St., Buffalo, N. Y.

GROBET SWISS FILES

Standard of excellence for more than a hundred years.

Write for our Catalog A

GROBET FILE CORPORATION OF AMERICA

3 Park Place **New York City**

Square and Hexagon Holes *Drilled*

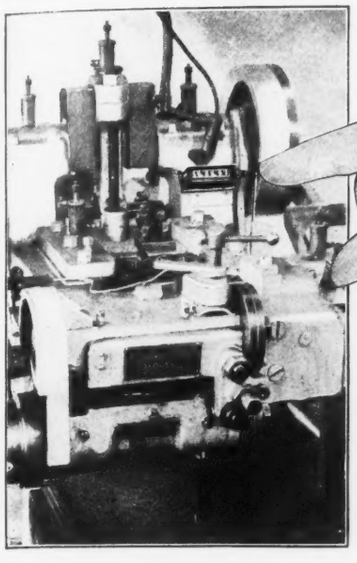
The Watts method of *drilling* triangular, square, hexagonal and other holes is faster, cheaper and unusually more accurate than other methods of doing the work. A practical operation with simple, practical tools. Let us tell you about it.

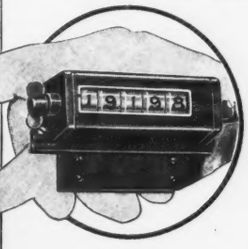
Watts Bros. Tool Works

760-70 Airbrake Avenue, WILMERDING, PA.

Make Machines *Self-Managing*

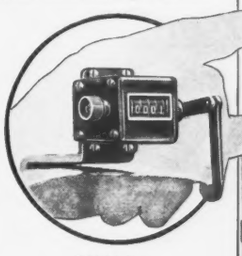
Veeder-ROOT
Re-set Ratchet Counters





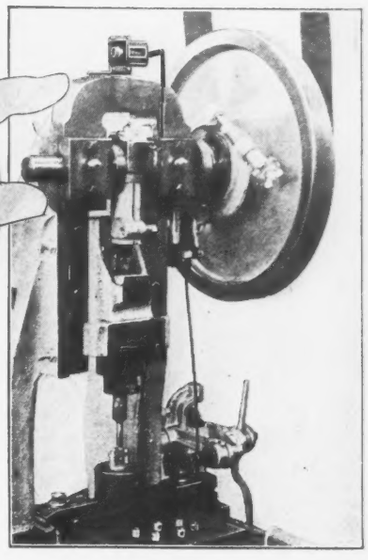
LARGE

The above large Re-Set Ratchet Counter is seen recording the output of a Rivet Header. It registers one for each throw of the lever, and sets back to zero by turning knob once round. Price with 5 figure-wheels as shown, $12.50 (list).



SMALL

Small presses like the one at right take the small Re-Set Ratchet Counter illustrated above. Each stroke of the press registers one on the Counter. Figures re-set to zero by turn of knob. Price, 5 figures as illustrated, $6.00 (list).



Let capacity output be assured—automatic—*part of the machinery* so far as possible. Let the operator see what the pace should be, and hold his machine to its high mark continuously. The Counter gets this *sustained work.*

The machine that records its production *manages itself.* Gets the attention it needs; gives the output *you* need. If the work slows down, the fact goes down on the Counter. It tells the operator to get busy. *Ask for data.*

Veeder-ROOT INCORPORATED HARTFORD, CONN.

OFFICES IN PRINCIPAL CITIES; WRITE OR PHONE.

Tycos Temperature Instruments

INDICATING—
RECORDING—
CONTROLLING

HUNDREDS FAHRENHEIT
0 2 4 6 8 10 12 14 16 18 20 22 24 26 28 30
RARE METAL
TAYLOR INSTRUMENT COS
Tycos PYROMETER
ROCHESTER NEW YORK U.S.A.

Tycos Wall Type Indicating Pyrometer

Tycos Duplex-Record Recording Pyrometer. Combination indicating and recording instrument. Produces two continuous records on single 50-day (1200 hr.) chart. Convenient, accurate and dependable.

INCALCULABLE losses result from lack of regulation or inefficient instruments.

Tycos Indicating, Recording and Controlling Devices are famous the world over for their long sustained accuracy and complete dependability—characteristics which manifest themselves in unbelievable plant economies. Wide selection of styles and sizes. Write for complete catalog.

Taylor Instrument Companies

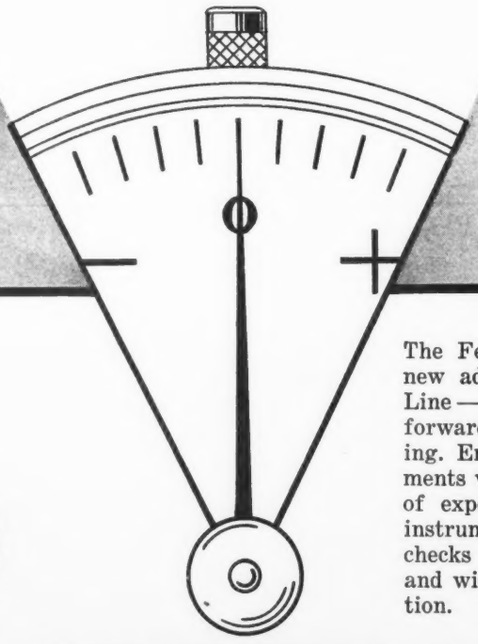
CANADIAN PLANT: Tycos Building, TORONTO, CANADA

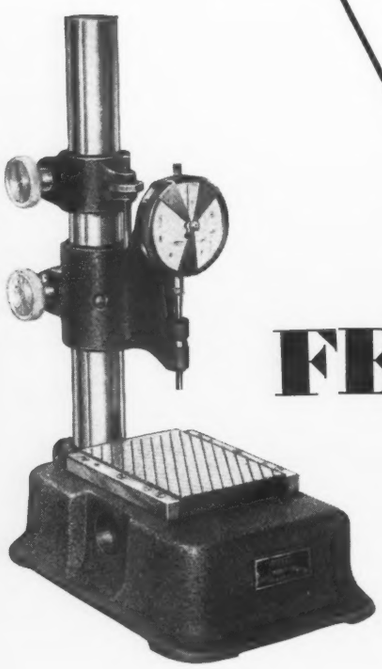
Established 1851
Rochester, N. Y., U. S. A.

Largest manufacturers of temperature instruments in the world.

See

By Direct Reading Your ± Limits





The Federal Comparator — a new addition to the Federal Line — represents a big step forward in production gauging. Embodying all the refinements which come from years of experience with precision instruments, the Comparator checks speedily, accurately and with minimum manipulation.

FEDERAL

Centers and Roller Type V Blocks are furnished when desired.

Set the V opening of the tolerance shutter, which is part of the standard equipment, to your plus or minus limits; if the needle is not visible in the V opening the measurement is not within limits. Dial is graduated so that .0001" reads like .001" on the ordinary indicator—another precision precaution.

We maintain a completely stocked Western Branch equipped to give prompt, dependable service.

FEDERAL PRODUCTS CORP.
PROVIDENCE, R. I.
WESTERN BRANCH: 7338 Woodward Ave., Detroit, Mich.

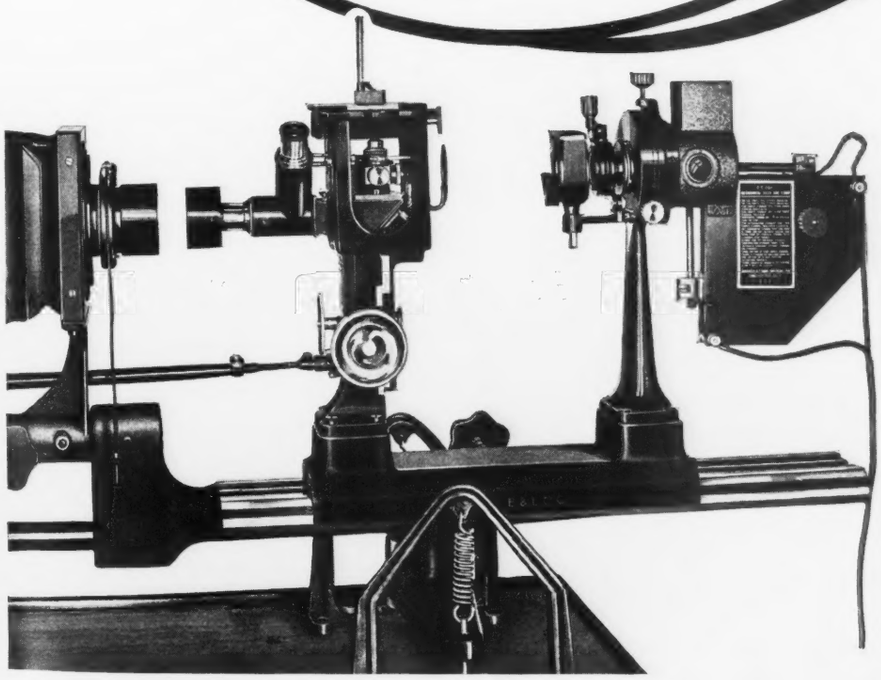
DIRECT READING COMPARATOR

Study the Structure— Control the Quality of Metal Products

Modern metallurgical practice makes it possible for the manufacturer in any line to know *exactly* what effect variation in composition, heat treatment, etc., has on his product, by the use of B. & L. Metallographic Equipment.

Exceptionally fine adjustments that make it possible to obtain plate definitions to 6000 times and more; design that eliminates danger of vibration between the specimen and the optical axis of the instrument makes it possible to obtain practically perfect definition at any desired magnification, with any required exposure.

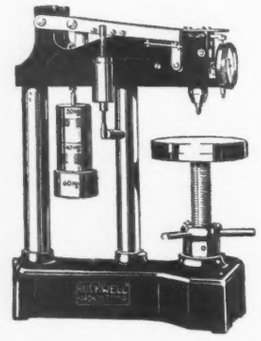
The Bausch & Lomb Large Metallographic Apparatus efficiently meets the needs in the industrial research and factory laboratories. Details of design and application will interest every metallurgist. May we send them?



BAUSCH & LOMB OPTICAL CO.
662 St. Paul Street
ROCHESTER, N. Y.

BAUSCH & LOMB
LARGE METALLOGRAPHIC APPARATUS

ROCKWELL TESTING *for* SPECIFICATIONS



We quote the following—

I WOULD be very unappreciative of the service that this machine has given us were I not to convey to you in somewhat glowing terms my feelings in regard to this particular article.

WE use it continually on sheets, etc., and it has given us an insight as to what is necessary in the way of hardness in the materials we use that we could not otherwise obtain.

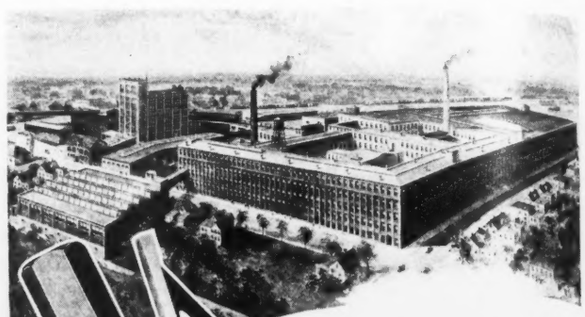
OUR steel purchases amount to possibly one million dollars ($1,000,000) a year, and it must be conceded at once that there must necessarily be a very close cooperation between the Inspection Department and the steel plants furnishing our raw material.

IN fact, this relation is so very close that practically all of the steel companies who have delivered us steel in the last two or three years have put in a Rockwell Hardness Tester, and by comparison between the results obtained from both machines, the one in their plant and the one in ours, the proper hardness of our material is easy to be obtained.

FRANKLY, we never knew how to tell the other fellow what was necessary until this system was put in, and it works wonderfully well. The basis of comparison between the machine in our hands and in the hands of the steel plants is firmly established after we once know that this test piece gives the same reading on our machine as it does on the one at the steel plant. We can safely go ahead and tell them exactly what we want. I do not believe that there ever was anything purchased by this plant that gave more universal satisfaction, and the efficiency that the Inspection Department has had in being able to recommend to our Purchasing Department the kind of steel to be bought is largely due to the information that this machine has given.

JOHN WOOD MFG. CO.,
H. L. KOENIG,
Asst. Mgr., In charge of Inspection.

WILSON-MAEULEN CO
INCORPORATED
382 Concord Ave. :-: New York



From this Mammoth Up-to-Date Plant-

comes the finest line of Production and Inspection tools obtainable.

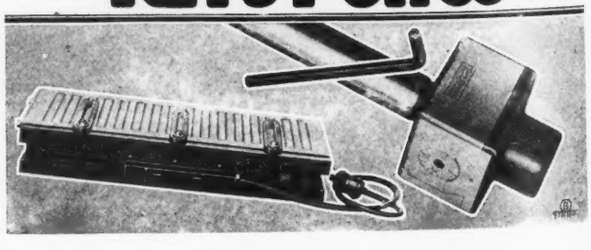
Every Taft-Peirce tool is tested and proved under the exacting requirements of Taft-Peirce manufacturing and inspection departments before it is placed upon the market. Tools that survive such a "proving ground" are sure to maintain Taft-Peirce standards of accuracy, durability and convenience.

No matter how small or how large your Inspection and Production Departments are—their speed and accuracy can be greatly improved by the use of these "tried and tested" tools.

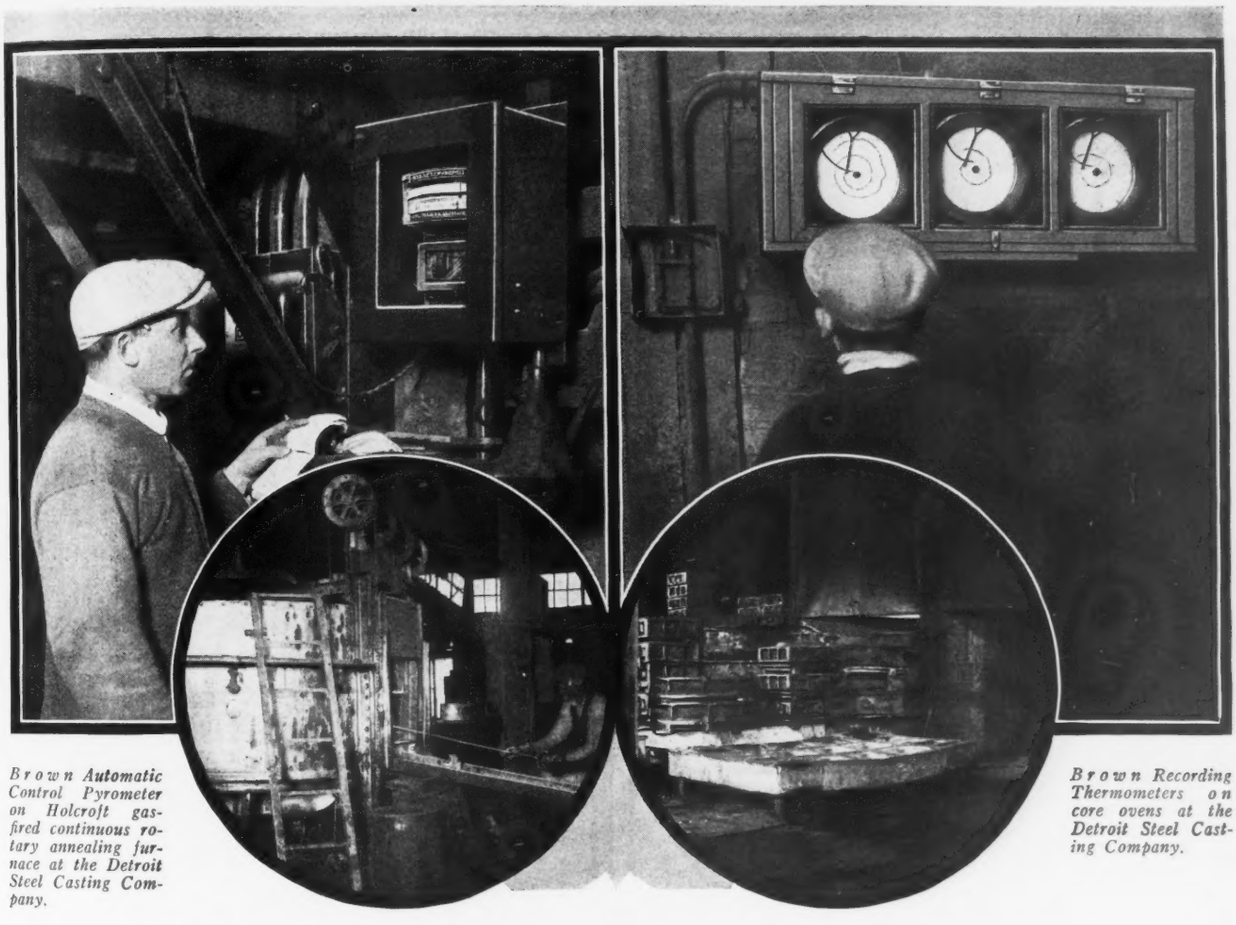
Would you like a copy of our Handbook? Write—

The Taft-Peirce Manufacturing Company
WOONSOCKET RHODE ISLAND, U.S.A.

Taft-Peirce



Better cores-better anneals -better castings



Brown Automatic Control Pyrometer on Holcroft gas-fired continuous rotary annealing furnace at the Detroit Steel Casting Company.

Brown Recording Thermometers on core ovens at the Detroit Steel Casting Company.

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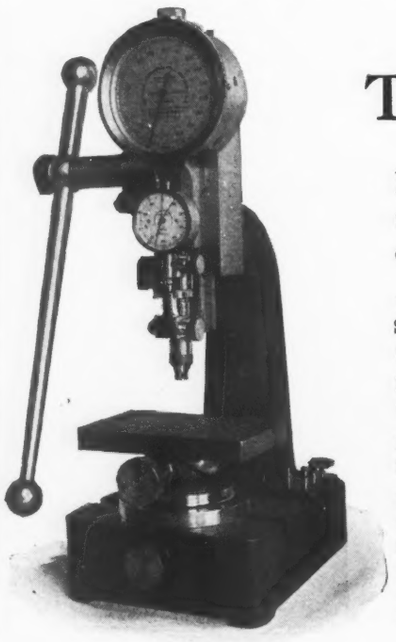

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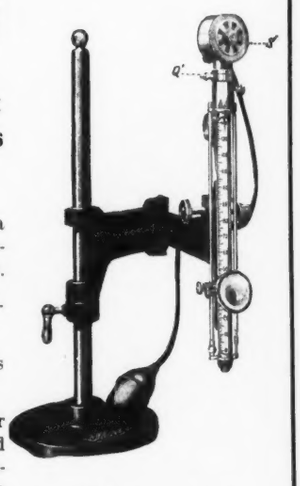

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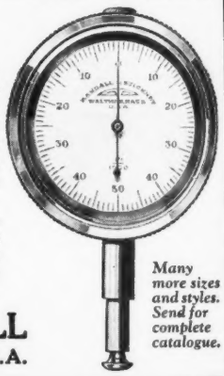

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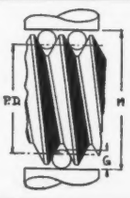

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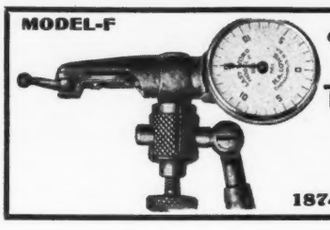

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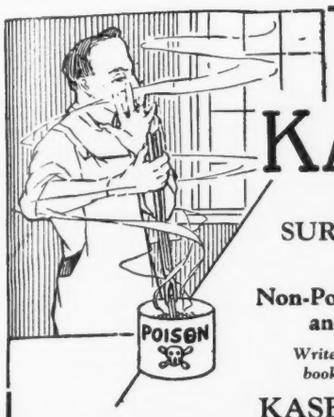

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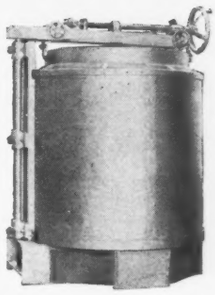

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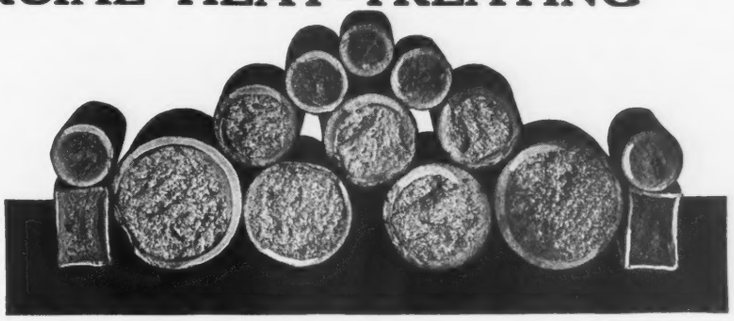

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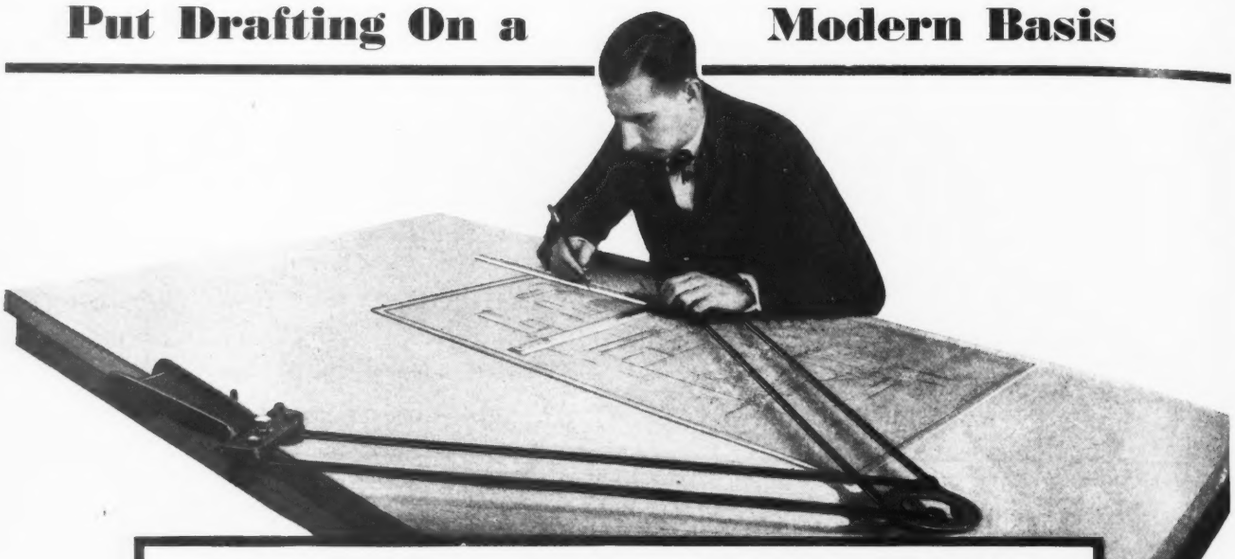

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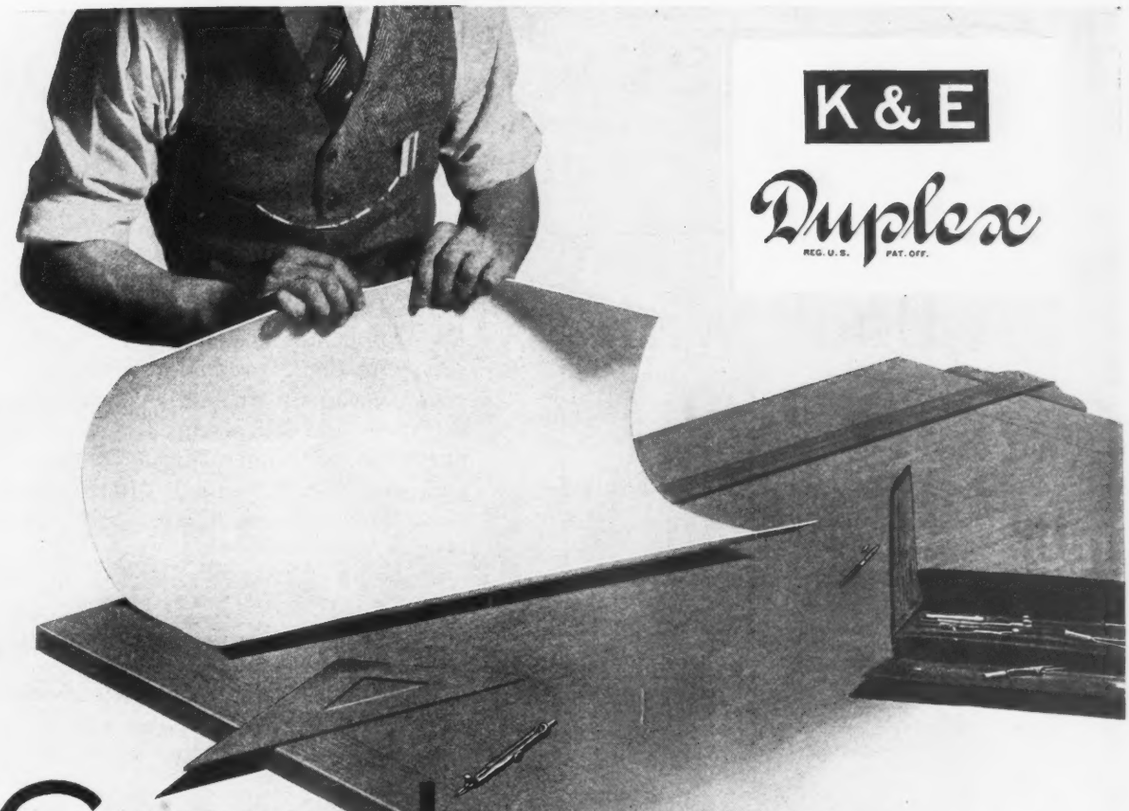

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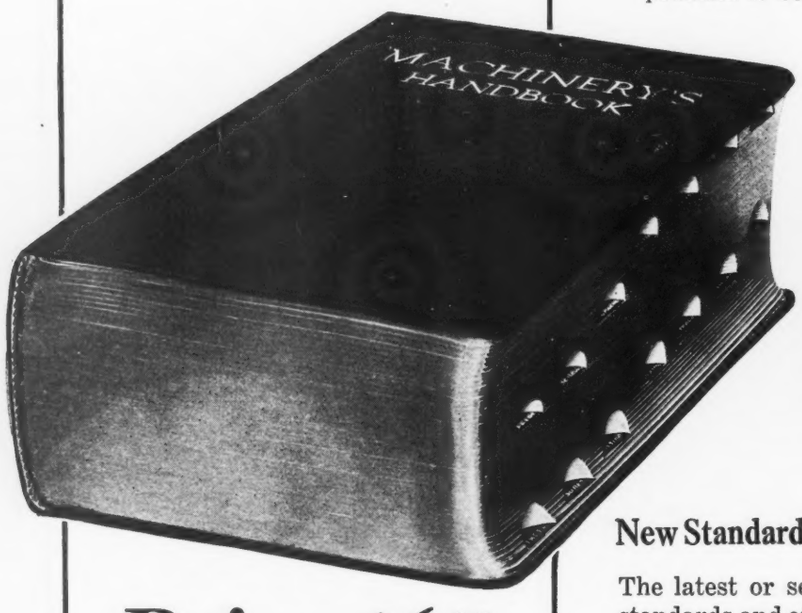

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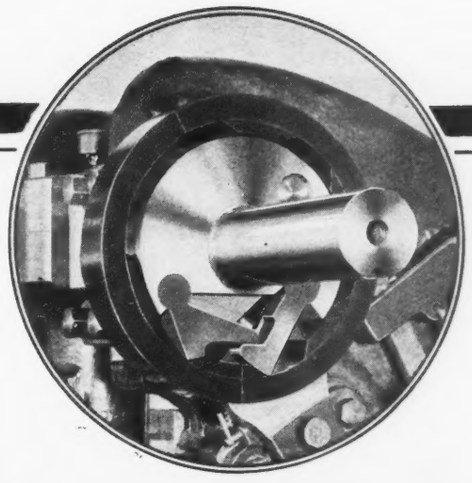

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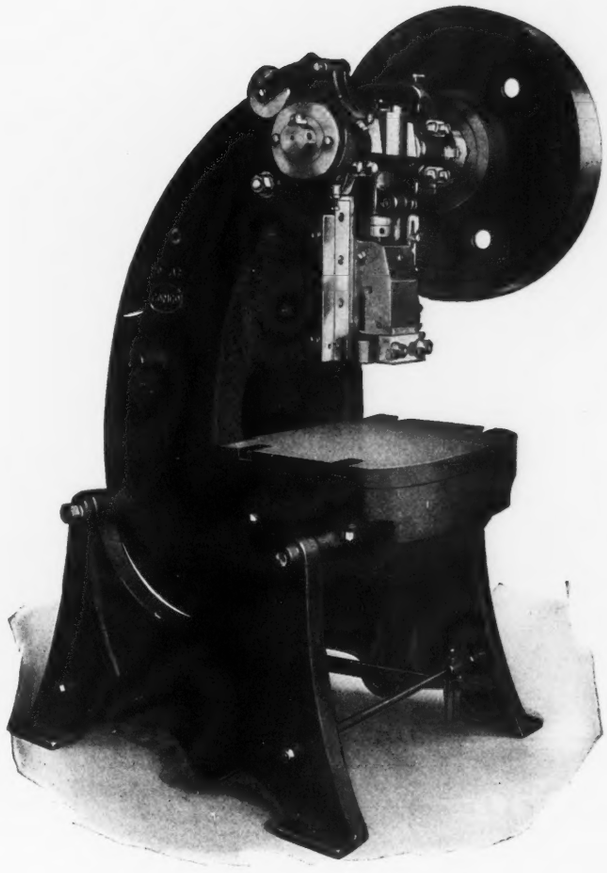

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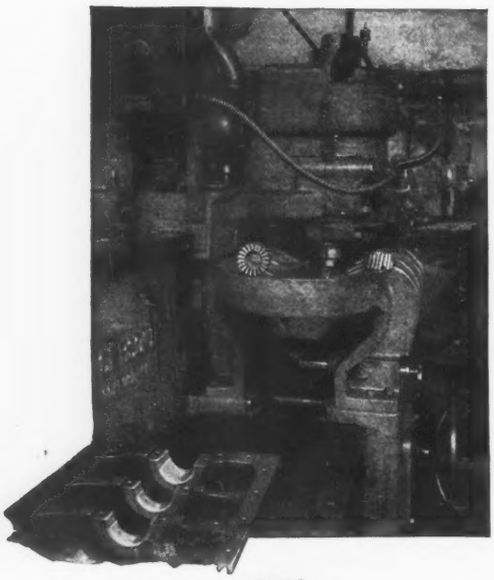

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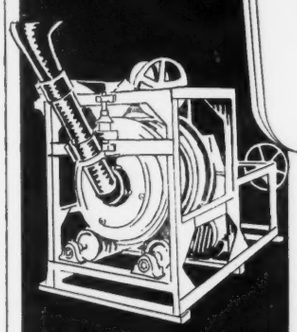

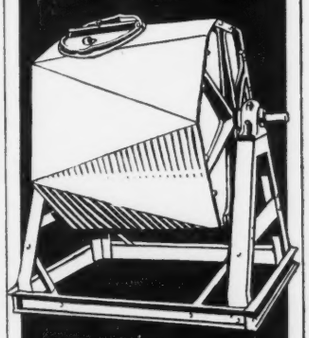

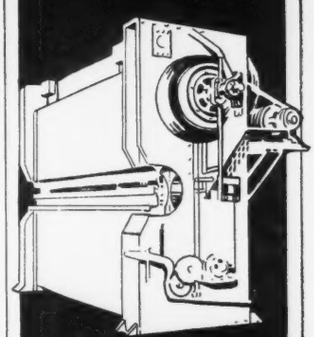

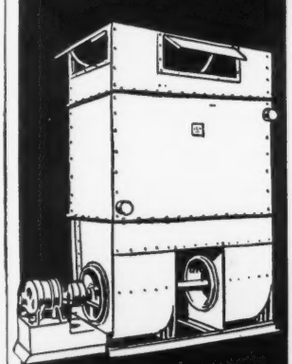

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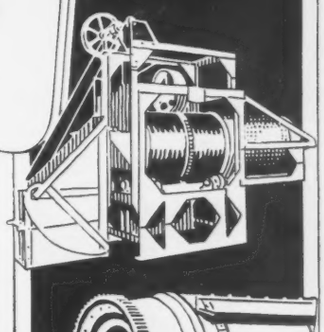

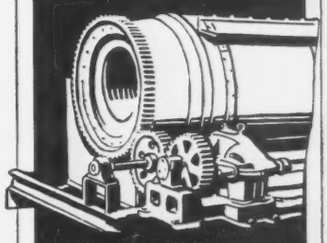

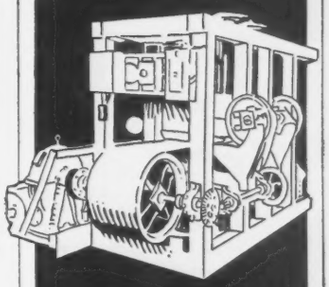

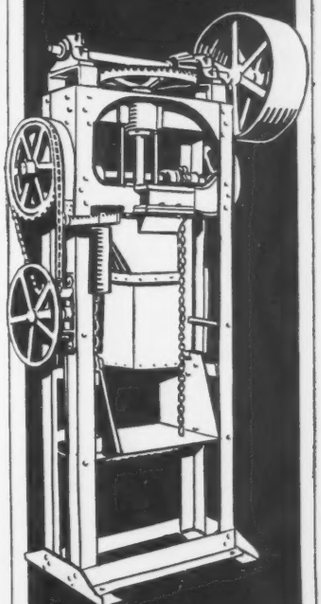

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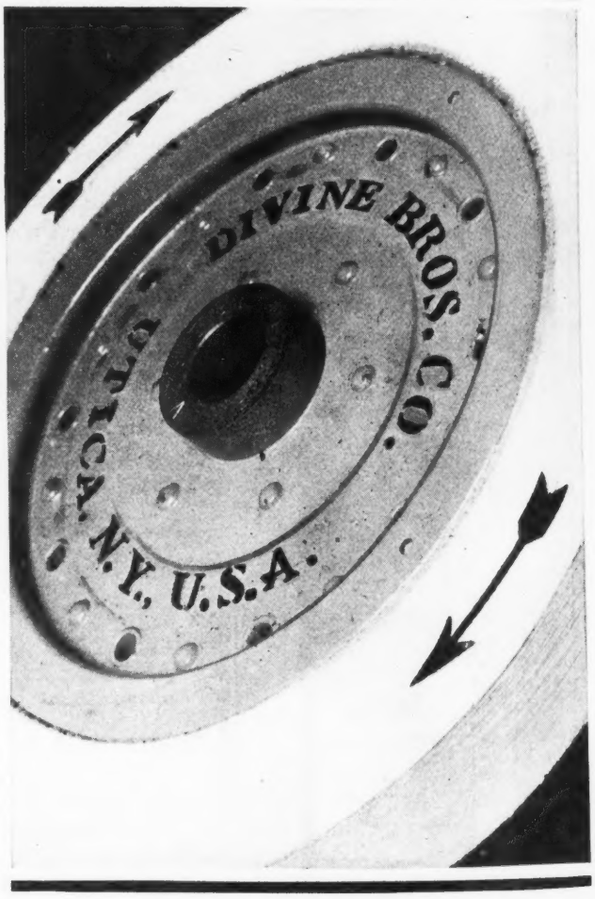

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1—30" Bullard Vertical.
2—42" Bullard Vertical—2 Heads.
1—51" Bullard Vertical—2 Heads.
1—42" Niles-Bement-Pond Car Wheel Borer.
1—No. 44 D. & H. Floor Type, 3 1/8" Bar.
1—5" Detrick & Harvey Horiz., Floor Type.

BOLT CUTTERS & PIPE MACHINES
¾" Geometric Single Head.
½" and 1½" Acme Double Head.
1—2½" Acme Single Head—M.D.
1—4" Bignall & Keeler, Cap. 1" to 4".
1—No. 11½ Merrill, Capacity 2½" to 12".

GRINDERS
1—No. 1 Norton Universal Cutter.
1—12" x 24" Modern Plain.
1—5 H.P. U.S. Double End, Cap. 18" x 3".
1—7½ H.P. Ransom, Heavy Duty.
1—No. 16 Besly D.E. Surface.
1—No. 3 Ohio Tool and Cutter.
1—No. 2½ Bath Universal.

SHAPERS
1—16" Gould & Eberhardt B. G. Crank.
1—20" Ohio Crank.
2—24" Gould & Eberhardt.
1—24" Stockbridge B.G. Crank.
1—36" Gould & Eberhardt.

PLANERS
1—24" x 24" x 8' Powell—Rev. M.D.
1—30" x 30" x 8' Woodward & Powell.
1—33" x 33" x 12' Cincinnati—2 Heads.
1—48" x 48" x 14' Betts—3 Heads.
1—48" x 42" x 12' Cincinnati, 2 Heads.
1—72" x 72" x 24' D. & H., Open Side.
1—48" Turner Frick, Rotary.

MILLING MACHINES
1—No. 1 Bilton Automatic Gear.
2—No. 2 Ohio, Plain.
1—No. 2A Milwaukee, Plain.
1—No. 5-B Becker Vertical.
1—No. 7-H Becker Manufacturing.
1—No. 3 Cincinnati Plain—M.D.
1—No. 4 Hendey Plain—S.P.D.
1—No. 5 Becker Vertical.

DRILLING MACHINES
2—Namco Six-Spindle Drillers.
20" and 21" New Buffalo and Canedy-Otto.
1—25" Weigel Sliding Head, Tapping Att.
2—No. 12 P. & W. Multiple Spindle, 12-1" Sp.
2—D-2 Colburn Heavy Duty—No. 5 Taper.
2—No. 25 Foote-Burt Heavy Duty.
1—3' Mueller Radial, G.B., S.P.D.
1—4' American S.P.D. T. A.
1—5' Western S.P.D. T.A.
1—6' Cincinnati-Bickford, Universal.
1—6' Reed-Prentice Radial, Late Type, M.D.

LATHES
1—16" x 8' Champion 2 Cylinder, T.A.
1—18" x 8' L. & S. 2 Cylinder, T.A.
1—16" x 8' Sidney, Q.C.G.
1—18" x 10' Whitcomb-Blaisdell, Grd. Hd.
1—19" x 12' Sidney, Q.C.G. Taper Attach.
1—24" x 10' Whitcomb-Blaisdell, G.H.
1—26" x 14' L. & S. 2 Cylinder, T.A.
1—14"-28" x 6' Fay & Scott Gap.
1—48" x 18' 9" Betts-Bridgeport, Heavy Duty.

TURRET LATHES & AUTOMATICS
1—2½" Cleveland Model A.
1—No. 4 W. & S. G.F.H. Power Feed.
1—18" Libby Rapid Production.
2—21" Gisholts.
1—3" x 36" Jones & Lamson, Fully Equipped.
1—2¼" Cleveland Model "B" Single Spindle.
1—3¼" Cleveland Model "A" Single Spindle.
1—⅞" Cone—M.D.—Latest Type.
1—⅝" Cleveland Model B.
1—No. 52 National-Acme, 4-Spindle, M.D.
3—No. 53 National-Acme, 4-Spindle.
3—Cleveland Model "A" 1¼ Spindle.

MISCELLANEOUS
1—No. 27 W. & W. Bulldozer M.D.
1—No. 29 W. & W. Bulldozer M.D.
1—Bertsch Squaring Shear, 10'x14 Ga., B.D.
1—Cadillac D.E. Centering Machine.
1—No. 20 Bliss O.B.I.
1—No. 5 A Toledo.
1—Shuster Straightening Machine, ¾"x12' Cap.
1—No. 786 Wickes Punch, 48" Throat, Cap. 1¼" x 1¼".
1—No. 13 Brown & Sharpe Gear Cutter.
1—No. 3 Baker Keyseater, Cap. 2".
1—300-lb. Bradley Upright Helve Hammer.
1—250-lb. Chambersburg Drop Hammer.
1—1500-lb. Erie Steam Forging Hammer.
3—No. 15 Bliss Double Seamers.
7—No. 10 Leffler Double Seamers.

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Bolt Cutters, 2", 2½" Landis Dbl. Hd.
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42" Gisholt, Vertical.
96" Niles.
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Drills, D-66 Moline 4 Sp. "Holehog."
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32" Hamilton, Sliding Hd.
Radial, 3' Marsch, sens. M.D.
Radial 3' Cincinnati-Bickford.
Radial, 3' Mueller.
Radial, 5' Cincinnati-Bickford Universal.
Radial, 6' American.
Grinders, Two No. 2 B & S 6" x 32" Plain.
10" x 50" Norton Pl.
No. 16 B & S 10" x 72" Pl.
No. 1 W & M, Universal.
No. 1 Diamond 24" x 12" x 12" Surface.
Hobbers, Nos. 3 and 12 Barber-Colman.
Keyseaters, No. 3-A Mitts & Merrill.
Lathes, 14" x 8' American, Motor Drive.
24" x 12' L & S, crankshaft.
Millers, No. 2-A Becker, vertical.
No. 2-B K & T., pl. Dbl. overarm.
No. 3 Cincinnati, pl. geared Hd.
Thread 6" x 80" P & W.
Pipe Machine, 6" Landis.
Planers, 36" x 48" x 10' Cleveland O.S.
Planer 16' Niles Plate.
Presses, No. 12 Toledo, Horning.
No. 21-B Bliss O.B.I. geared
Riveter, 30-ton Hanna 48" thr. ⅞" hot rivets.
Saw, 12-B Higley, Cold metal.
Screw Mach., No. 4 Warner & Swasey, fric. hd.
Shapers, 24" Gould & Eberhardt, Back geared.
28" Rockford.
Shear, 4' Loy & Nawrath, 10 ga. Power.
Woodworker, No. 58 Crescent, M.D.

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COLUMBUS Dept. M OHIO

Automatics, Nos. 52, 53, and 55 National Acme.
Boring Mill, No. 3 Colburn, hex turret.
Compressors: 6x5, 7x5, 6x6, 7x6 9x8 and 10x9.
Drill: Hilbert 3' radial.
Drill: Baush 5' radial.
Drills, 20" wheel and lever B.G. Power feed.
Drills: 32" Hoefer, sliding head.
Drills, No. 66-D Hole Hog seven-spindle.
Gear Cutter, No. 3-B 26" B. & S.
Gear Cutter, No. 13 Brown & Sharpe.
Grinders, surface No. 1 and No. 78 W. & M.
Grinders, No. 60 Heald cylinder.
Grinders, No. 20 Bryant Deep Hole chucking.
Grinder, Universal, 12x38 Cincinnati.
Grinder, No. 10 Besly 18" double disc.
Lathes, 14" x 6' Monarch quick change geared.
Lathes: 14" x 6' Sebastian motor drive.
Lathes, 14" x 8' Sidney, new quick change geared.
Lathe, 16" Hamilton, new model, rapid production.
Lathe, 24" x 24' Prentice.
Lathe, 20" x 10' Hamilton, quick change.
Lathe, 21" x 10' LeBlond.
Milling Machine: Ingersoll horizontal.
Milling machines, Brown & Sharpe plain.
Milling machines, No. 2 and No. 3 Kempsmith plain.
Milling machines, No. 2 heavy B & S plain.
Planer, 36" x 36" x 12' Gray, motor driven.
Planer, 42" x 42" x 12' Gray.
Planer, 36" x 36" x 14' Gray.
Press, No. 1, 1½, 2, 2½, Robinson O.B.I.
Press: No. 5 Federal O.B.I.
Punch and Shear, ½ x ½—10" throat.
Screw machine, No. 1 Foster automatic chuck.
Shaper, 16" American back geared crank.
Shaper, 16" Steptoe crank.
Shapers, 24" O. & S. crank.
Shears, No. 13 Pettingell rotary.
Square Shear, No. 362 J. M. Robinson.
Turret Lathe: Defiance.
Turret Lathe, 1" & 1⅝" Millholland.
Turret Lathes, No. 1 Foster.
Washing Machine, Blakeslee.

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Air Compressor, 6x6 Worthington FV
Air Compressor, 9x8, 12x10 I-R, type ER1
Bending Rolls, 62"x5/16" Beloit
Bending Rolls, 62"x3/16" Badger State
Bending Rolls, No. 8 & No. 9 Bertsch, MD
Bending Rolls, 10'x½" Cap. Scully, MD
Bending Rolls, 16'x¾" Cap Niles
Bolt Cutter, 4" Acme, MD
Bolt Cutter, 1½" Acme, 'A', 2 spindle
Bolt Cutter, 2" Morgan
Boring Mills, 36" & 42" Bullard
Boring Mill, 42" NBP Vertical Turret
Boring Mill, 50", 66" Niles
Boring Mill, 60", 72" Bullard
Boring Mill, 84", 96" Niles
Brake, 4'x10 Ga. Robinson
Brake, 6'x18 Ga. Keene
Brake, 8'x16 Ga. Robinson
Brake, 8'x10 Ga. Robinson MD
Brake, 8'x16 Ga. Pexto
Drill, 22" Barnes Gamel Back
Drill, 26" Cincinnati Upright
Drill, 2½' Dreses Cone Drive
Drill, 3' Mueller Cone Drive
Drill, 3½' Cincinnati-Bickford
Drill, 4' Bickford GB
Drill, 4½' Morris, MD
Drill, 6' American T.G.
Grinder, 84" Diamond Surface
Grinder, No. 2 Diamond Surface
Grinder, No. 2 B&S Surface
Grinder, 10x30 Queen City Plain
Grinder, 10x36 Landis
Hack Saw, 6x6 Racine or Peerless
Hack Saw, No. 7 Atkins
Keyseater, No. 1 & No. 2 Davis
Keyseater, No. 0, No. 2 M&M
Keyseater, No. 3½ Baker
Keyseater, No. 3 M&M
Lathe, 16"x6' Monarch QC
Lathe, 18"x10' Cincinnati QC
Lathe, 18"x14' G-K, LC
Lathe, 22"x19' American GH
Lathe, 24"x12' B&E, QC
Lathe, 26"x12' Wickes SQC
Lathe, 27"x21' L&S, QC
Lathe, 36"x21' Johnson
Lathe, 36"x26' Wickes, SQC
Lathe, 54"x27' Pond
Miller, No. 1B Milwaukee
Miller, No. 24 Oesterlein Plain
Miller, No. 2, No. 3 LeBlond
Miller, No. 3 B&S
Miller, No. 3, No. 4 Cincinnati Univ.
Miller, No. 4 Cincinnati Vertical
Miller, No. 3 LeBlond Univ.
Miller, US Hand
Pipe Machine, 6" Williams
Pipe Machine, 12" Saunders
Pipe Machine, No. 5½ Merrill
Planer, 42x36x12 Cincinnati
Planer, 24x24x8 American
Planer, 48x48x14 Gray
Planer, 60x60x14 Cincinnati
Planer, 72x72x20 Ridgway
Planer, 72x72x18 D&H
Planer, 36x36x12 Cleveland
Shaper, 14", 16" & 18" Steptoe
Shaper, 26" Niles Traveling Head
Shaper, 22" American BG
Shaper, 24" Queen City
Punch Press, No. 8-A Bliss
Punch Press, No. 8 Whiting
Shear, No. 4 L&A Universal
Shear, 42"x18 Ga. Niagara
Shear, 6'x10 Ga. Power
Shear, 8'x16 Ga. Bertsch
Shear, 8'x14 Ga. Canton
Shear, No. 196 Niagara
Shear, 10'x14 Ga. Bertsch
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1¼" Gridley 4 spdle. model F	$1150
2¼" Gridley 4 spdle. model F	2500
Auto. Cincinnati 5 spdle. ¾"	500
Auto. Cleveland ⅝ Model A	150
P & W ⅝x4, complete	150
No. 7 Foster 2¼" P. F.—F. Hd.	750
24" Steinle 5' hole side carriage	700

BORING MILLS

Horz. 4" Rochester floor type, Rot. table M.D., rapid P. T.	4500

DRILLING MACHINES

1 spdle. Allen H.S. B.B. 14" with pump	125
Radial 3' American Sensitive	200
4-spindle Barr Plain Bearing	225
24" Rockford Sli. Hd. B.G.	150
28" Superior Sli. Hd. B.G.	325
21" Cin. Sta. Hd. with tapping attach.	200
24" Cincinnati sliding hd. with tap. att.	325
20"—2-spindle Hoeffer Power Feed	250

GRINDING MACHINES

24" Diamond with Disc and ring wheel	300
26" Valley City disc	250
No. 65 Heald with fixtures B.B. spdle.	900
No.1½ Cincinnati cutter and tool	450
16"x36" cap. Diamond Auto. Surface	1000
12x12x48 Springfield Brandes Surface Magnetic Chuck & Segment Wheel	2000
No. 11 B. & S. plain 6"x32"	400
Landis 16"x42" plain, 24" wheel	1000

LATHES

14"x8' Flather Q.C. Taper & Ck.	250
18"x9' Chard Semi-Q.C.	400
18"x11' Chard Semi-Q.C.	425
22"x10' Davis quick change	800
42"x20' Fifield with blocks to swing 60"	1000

MILLING MACHINES

Whitney, Stand. & U. S. (Hand)	125
No. 21 Garvin Power Feed-Oil Pump	150
No. 12 B & S Prod. Type	150
No. 3B B.&S. Hvy Dty, all G.H., S.P.D.	2000
Briggs (G. & E. Mfg. 16")	200
No. 7 Becker Lincoln type	150
No. 5 Becker Vertical, no rotary	500
No. 3 Becker Vertical	325
Hendey Lincoln type	100
Ingersoll Slab 42x36x9'	1750

SHAPERS

16" Steptoe, crank, back grd., vise & c/s	375
16" Smith & Mills, back grd., vise & c/s	450
20" Steptoe, crank, back grd., vise & c/s	500
20" Cincinnati, crank, back geared, vise & c/s	850
20" Ohio, c'k, B.G., vise & c/s, near new	1000
25" Steptoe, crank, back grd., vise & c/s	750
Slotter 12" Putnam Universal	1000

PLANERS

24" Rockford Univ. Comb. Planer	1100
24x24x6' Cincinnati, 1 head	500
26"x26"x6' Cincinnati, 2 heads	750
24x24x8 Fitchburg, 1 head	400
32x32"x8 Pond, 1 head	750
36"x36"x12' Cincinnati, 2 heads	1500

PRESSES

No. 5 R &K—OBI—5500 lbs.	525
Ohl Power Press Brake 10' No. 10 ga.	1650

MISCELLANEOUS

Hammer, 50 lbs. No. ½ Standard Drop	150
Hammer, No. 5A High Speed Riveter	400
Bolt Cutter, 2" D & H Double Head	300
Centering Machine Whitop Swivel	75
Filing Mach., Cochrane-Bly Floor Type	100
Oil Separator National about ½ bu.	75
Saw, 6x6 Peerless H.S. D.C.M. $150, A.C.	175
Saw, Racine Metal Band, nearly new	175

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No. 5 Cinti high power pl. S.P. Rect. Over-Arm, (Latest Type).
No. 3 Kempsmith Univ. C.P. Compl. late type.
Nos. 3 & 2 Brown & Sharpe Univ. C.P. compl.
Nos. 3 & 1 Hendey Universal, C.P. Compl.
No. 4 Cinti High Pr. pl. arr. for M. Dr. power rapid traverse, (Late Type).
No. 3 Hvy Ohio Pl. C.P. Pr. Rap. Trav.
Nos. 3 & 1 Kempsmith Plain, C.P.
Nos. 2-H & 1½ Brown & Sharpe Pl. C.P.
Nos. 3 & 1½ Cincinnati Plain, C.P.
No. 2 Cincinnati High Pr. Pl. S.P. Late Type.
No. 2 Knight Milling and Drilling Machine.
No. 15 Garvin Vertical Spindle Milling Mach.
48" Cincinnati-Auto. Duplex (Latest Type).
24" Cincinnati-Auto. Duplex (Late Type).
No. 33 Kempsmith Manufacturing Milling.
28" Cincinnati Semi-Auto. Duplex.
24" Cincinnati Auto. Milling (Late Type).
No. 3½ Fox Hand & Power Milling Machine.

RADIALS AND UPRIGHT DRILLS

5' American Triple Purpose pl. rad. gr. box dr. (Enclosed Head).
5' Cinti-Bickford pl. rad. gr. box dr. late type.
6' 5' & 4' Amer. Triple gd. pl. rad. gr. box dr.
4' Dreses high duty plain radial, gr. box dr.
4' Western high duty plain radial, gr. box dr.
3' Morris plain radial, gear box drive.
4' Hammond ball bearing sensitive radial.
36" 32" & 24" Aurora upr. dr. tap. att. L.T.
34" 28" & 26" W. F. & John Barnes upr. dr. Late Types.
26" Barnes all geared drill.
25" and 21" Superior upright drills.
25" Weigle upright drills (latest type).
24" Cinti-Bickford upright drill, tap. attach.
No. 314 Baker Brothers hvy duty drill.
No. 17 Foote Burte three (3) spdl hvy duty dr.
No. 220 Baker Bros. (2) spdle hvy duty dr. indexing table.
No. 2-B Edlund four (4) spdle ball bear. dr. No. 2 M.T.
Allen two and three spdle B.B. dr. No. 2 M.T.
No. 30 Natco multiple drill, late type.
No. 12 Natco multiple drill and tapper.

ENGINE AND TURRET LATHES

36"x42' Johnson triple gd. stand. change lathe.
36"x16' Lodge & Shipley selec. gd. hd. lathe.
30"x18' Lodge & Shipley sel. gd. hd. lathe, L.T.
28"x14' Lodge & Shipley Q.C. lathe.
25"x50"x18' LeBlond slid. bed exten. gap lathe Q.C. gears.
24"x12' American Tool Works Q.C. lathe.
20"x8' Hendey gd. hd. Q.C. lathe taper att. l.t.
18"x14' Johnson gd. hd. Q.C. lathe taper att.
18"x8' Lodge & Shipley sel. gd. hd. Q.C. lathe late type.
16"x8' & 16"x6' Lodge & Shipley sel. gd. hd. Q. C. lathe, late types.
17"x6' LeBlond geared head Q.C. lathe.
14"x6' Reed-Prentice geared head Q.C. lathe.
34", 24" & 21" Gisholt tur. lathes, taper att. late types.
No. 1-B Foster univ. tur. lathe, chuck, equip.
3"x36" Jones & Lamson tur. lathe, bar and chucking equipment.
Nos. 2, 4 and 6 Warner & Swasey tur. lathes.
Nos. 2 and 4 Millholland turret lathes.

SHAPERS AND PLANERS

24" Queen City hvy duty B.G. crank shaper, arr. for motor drive thru gr. box (L.T.)
25" & 16" Smith & Mills hvy duty B.G. crank.
24" and 20" Kelley hvy duty B.G. crank.
24" and 16" Barker B.G. crank shapers.
24" Walcott hvy duty B.G. crank, (helical gd.)
20" Milwaukee hvy duty B.G. crank shaper.
20" Cincinnati hvy duty B.G. cr. sgle pul. dr.
20" American Tool Wks high duty B.G. crank —arr. for M.D.
16" Gould & Eberhardt high duty B.G. crank.
16" Hollingsworth hvy duty B.G. crank.
15" Pratt & Whitney crank shaper.
24"x24"x10' Liberty planer—1 hd. late type.
30"x30"x10' American planer—1 head.
42"x42"x10' G. A. Gray planer—1 head.
42"x42"x12' Cinti Tu-Speed planer, 4 hds. late type, box table.
54"x54"x26' Niles-Bement & Pond planer—3 heads, arranged for M.D.

GEAR CUTTER AND GRINDERS

No. 3 & 12 Barber-Colman gear hob. (L.T.)
No. 18-H Gould & Eberhardt high duty gr. hob.
No. 5-A Lees Bradner gear hobbers.
No. 6 Fellows gear shapers.
No. 5 48" Brown & Sharpe auto. spur gr. cut.
18" Gleason bevel gear generator.
No. 22 12" Heald rotary surface grinder.
14" Pratt & Whitney vert. surf. grd. ball bear. spdle—rect. mag. chuck.
12" Pratt & Whitney vert. surf. grd. rotary mag. chuck.
No. 2 Wilmarth & Morman auto. surf. grinder.
No. 70 Heald internal gdr. clutch in hd. stk. l.t.
No. 11 Brown & Sharpe pl. self cont. gdr. L.T.
6"x18" and 10"x52" Landis pl. self cont. gdr. late types.
No. 2, 12"x36" Cincinnati pl. gdr. late type.
8"x30" Modern plain self cont. gdr. 95% new.
No. 2 Cincinnati univ. tool and cutter grinder.
No. 2 Oakley univ. tool and cutter grinder.

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Where is Your Left-over Machine?

The left-over machine discarded for the new just rusts, is useless, in fact becomes junk when left unused around the shop. Sell it for cash. Get back some of the money invested in it. You can do it through the Resale Section.

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36"x21' Johnson Engine Lathe.
36"x18' Fifield engine lathe.
27"x20' Lodge & Shipley, 3 S.C. Q.C.
22"x10' American, geared head, Q.C.
20"x8' Lodge & Shipley Geared Head, Q.C.

RADIALS AND UPRIGHT DRILLS

4' Bickford, single pulley.
3' Carlton Sensitive.
6 spindle, 20" Rockford.
26" Rockford, tap. att. latest type.
26" Cincinnati, late type.

GEAR CUTTERS AND HOBBERS

18" Schuchardt & Schutte Gear Hobbers.
36" Whiton Bevel & Spur Gear Cutter.
No. 3 26" Brown & Sharpe, late type.
No. 3 36" Brown & Sharpe, late type.

BORING MILLS

10' Niles, 2 heads.
42" Bullard, New Era type.
36" Bullard, Rapid Production.
No. 1 Rockford, Horiz. 2" bar.

SHAPERS AND PLANERS

16" Steptoe Crank Shaper, late type.
20" Steptoe Crank Shaper.
24" Queen City Crank, B.G.
26"x26"x12' Whitcomb-Blaisdell, 2 heads.
42"x36"x12' Cincinnati, 2 heads.
48"x48"x16' Detrick & Harvey Openside.
24" Hendey Friction Shaper.

MILLING MACHINES

No. 1½ Valley City, Plain.
No. 28 Oesterlein, Plain.
No. 3 Cincinnati, Universal.
No. 3 Brown & Sharpe, Plain.
No. 4 Brown & Sharpe, Plain.

GRINDERS

10"x20" Landis, plain.
10"x52" Landis, plain, self contained, like new.
16"x48" Landis crankshaft grinder, self contained.

MISCELLANEOUS

No. 8 Whiting Punch & Shear, 36" throat, 1" thru 1".
Wickes Punch & Shear, 48" throat, 1¼" thru 1¼".
½" Landis Double Spindle Bolt Threader.
2" Morgan Bolt Cutter, Complete.
10' Bertsch Power Squaring Shear, 14 gauge.

Cincinnati Machinery & Supply Co.
29 West Second St., Cincinnati, Ohio

SPECIALS

6' American Radial, Enclosed Head.
30"x30"x12' Cleveland Openside Planer.
No. 4 Cincinnati Vertical Miller.
36"x18' Schumacher Boye Lathe.
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48"x48"x10' Liberty 3-head Planer.
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84" and 120" Niles Boring Mills.
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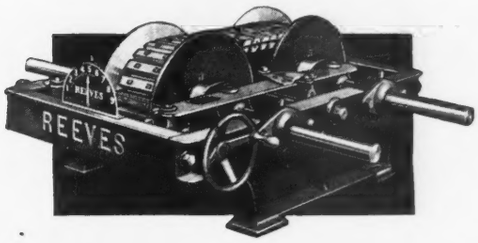

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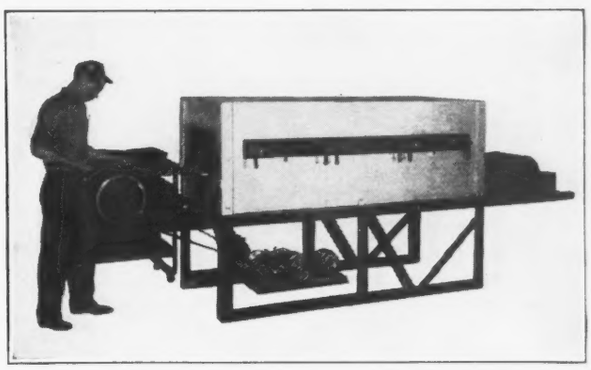
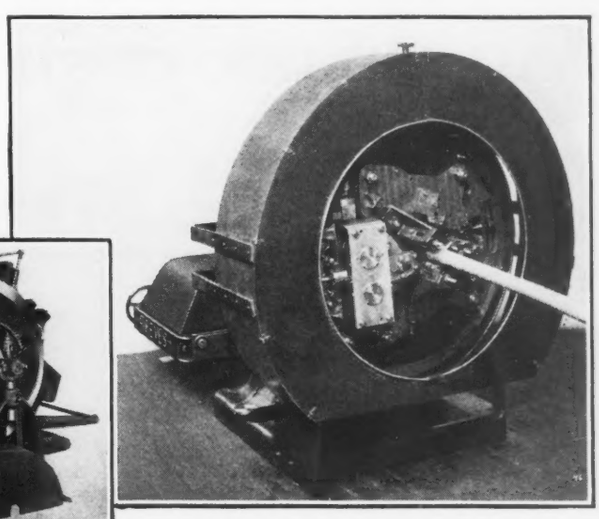
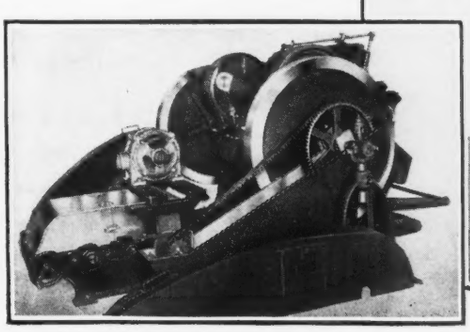


Above: REEVES-*equipped conveyor-type heat treating furnace manufactured by C. I. Hayes, Inc.*





Above: REEVES-*equipped Cutter and Creaser made by Thomson-National Press Co., Inc. Right:* REEVES-*regulated parkway cable armoring machine made by Sleeper & Hartley, Inc.*

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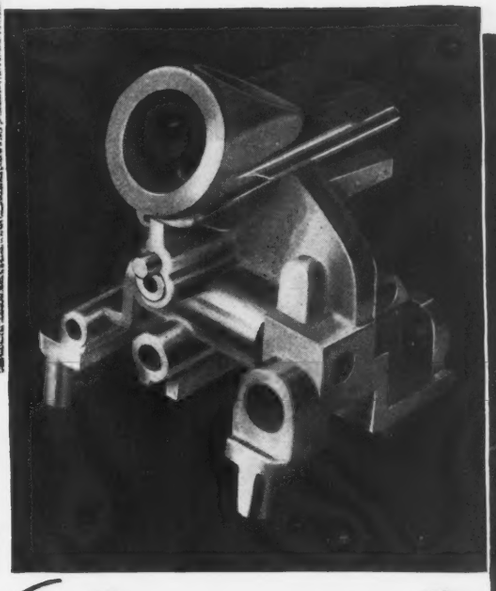

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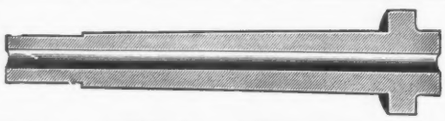

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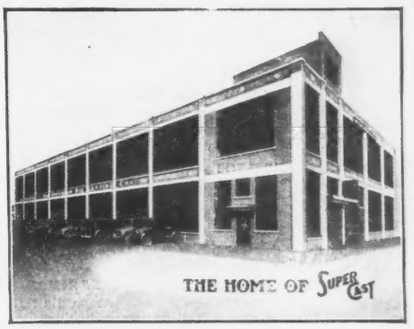

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French Oil Mill Mchry. Co., Piqua, O.
Watson-Stillman Co., 73 West St., N. Y.

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See Hoists, Air.

AIR TOOLS
See Grinders, Pneumatic; Drills, Portable Pneumatic, etc.

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See Boring Bars.

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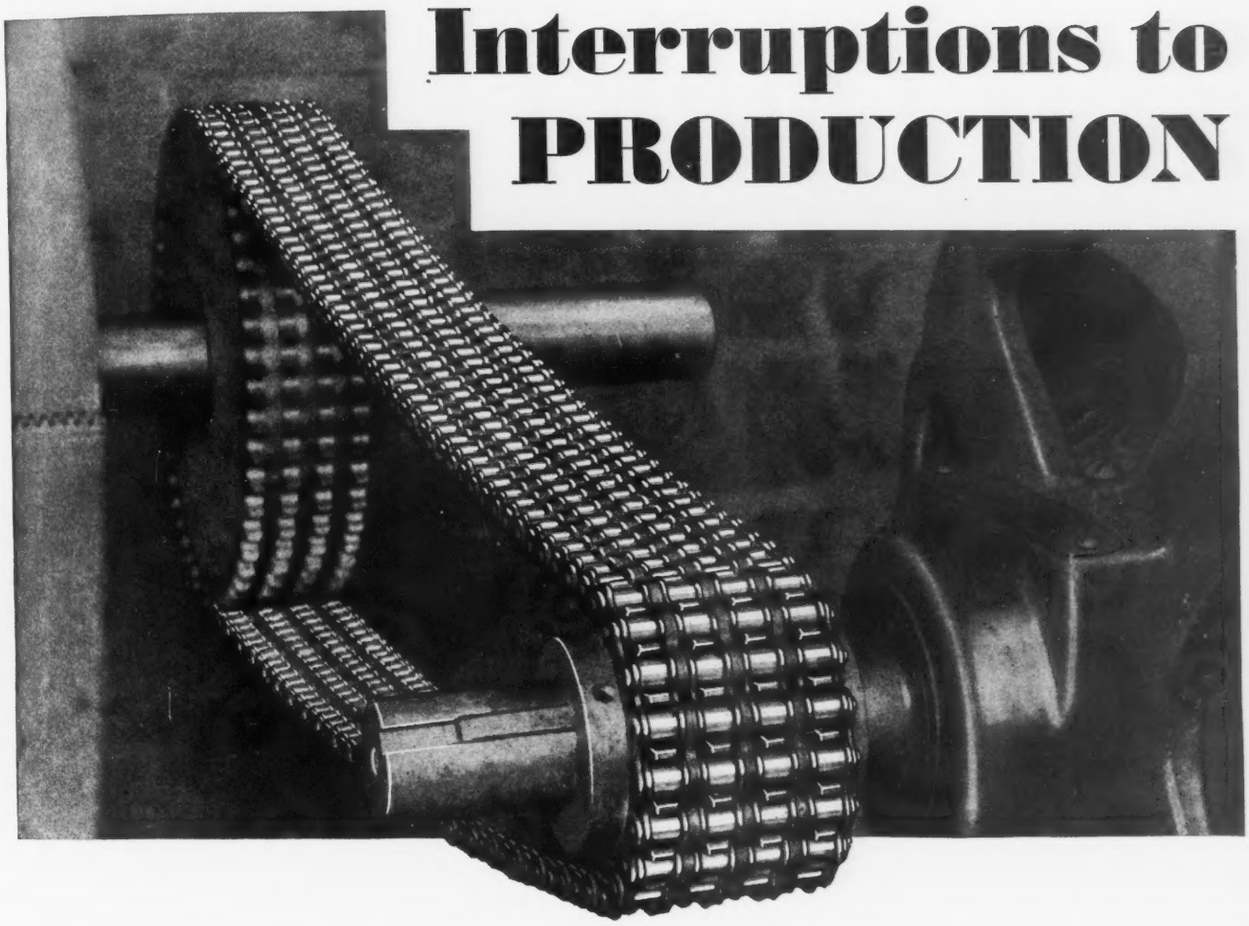

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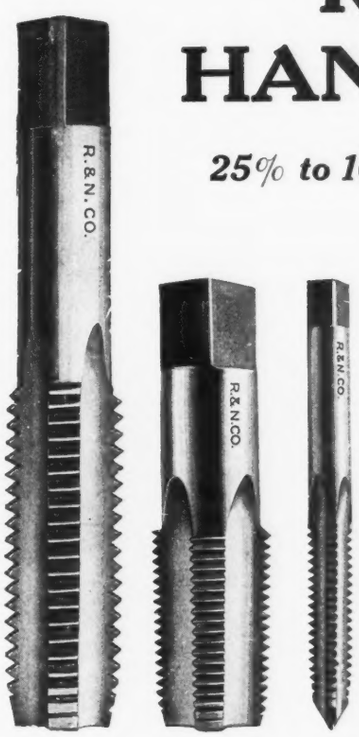

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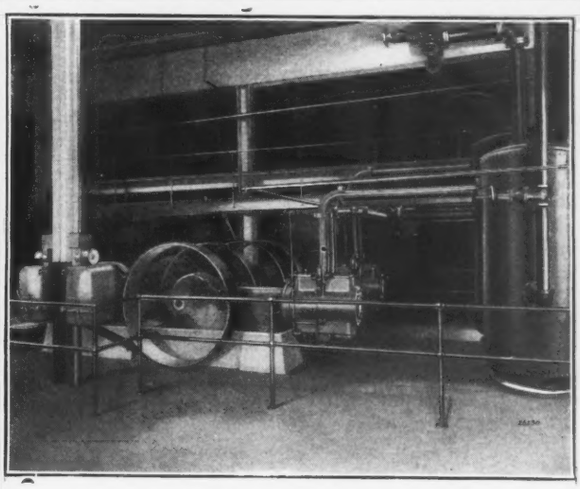

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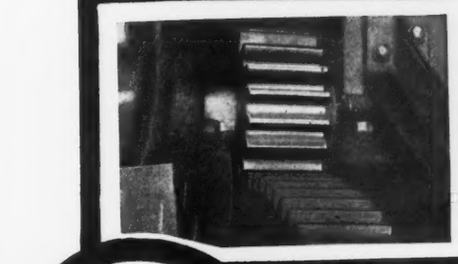

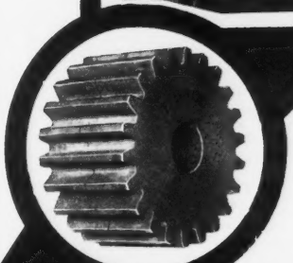

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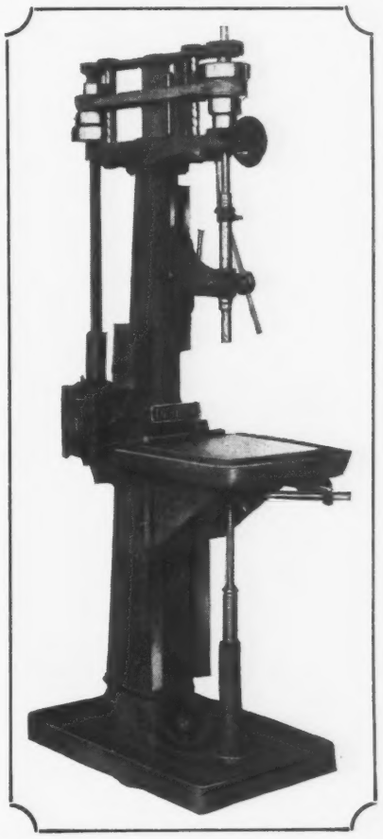

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See Dressers, Grinding Wheel.

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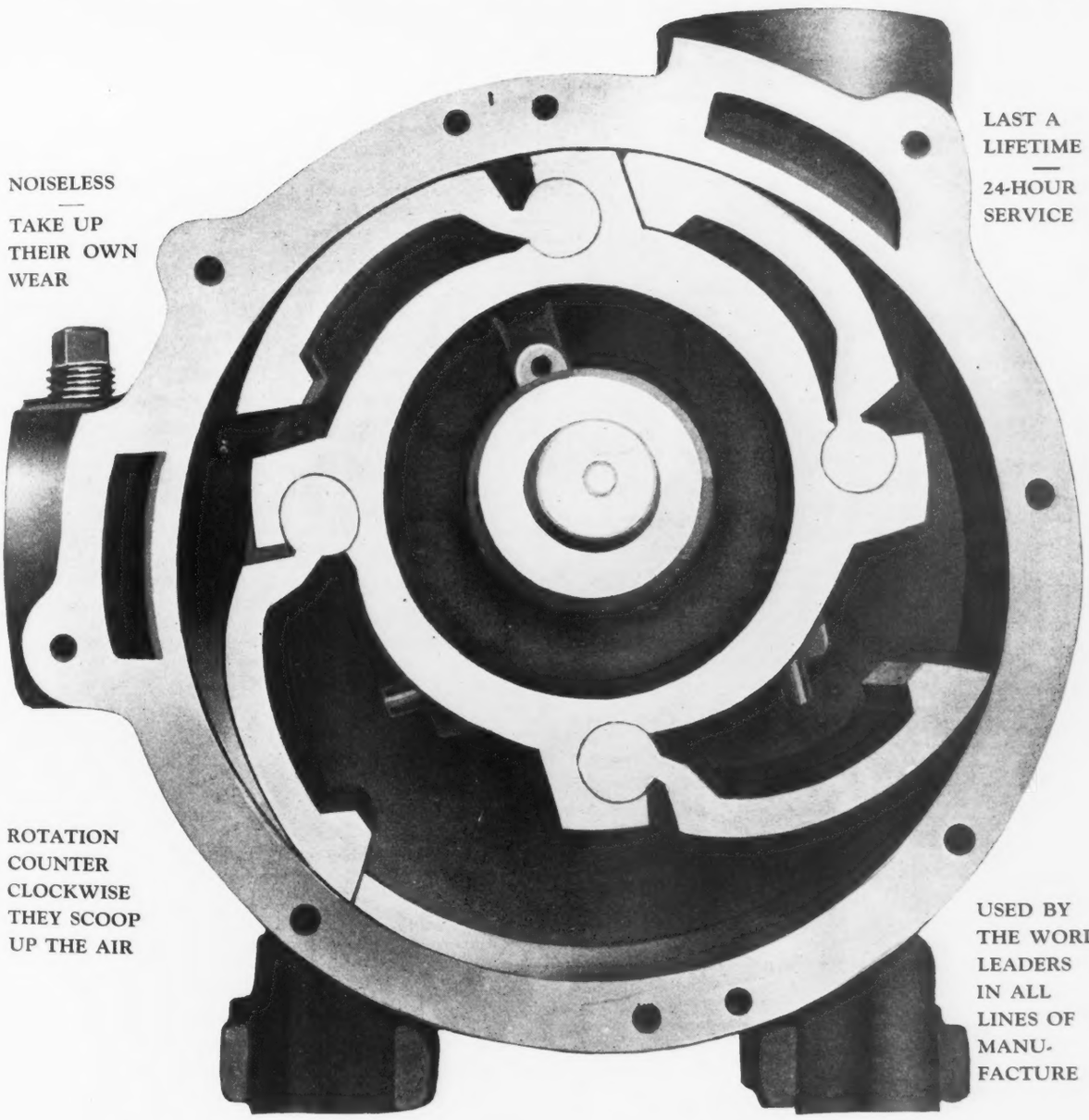

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Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.
Graham Mfg. Co., Providence, R. I.

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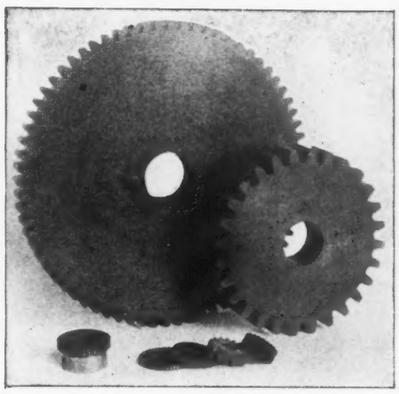
Mass. G&T Gears

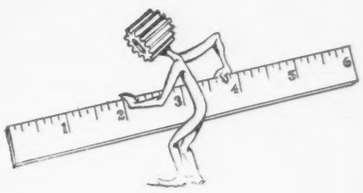
QUIET

LONG LIFE



We furnish Bakelite gears in any of the well - known trade names.

They will measure up to your expectation. Assured through correct engineering and accurate machining.



Massachusetts Gear & Tool Co.

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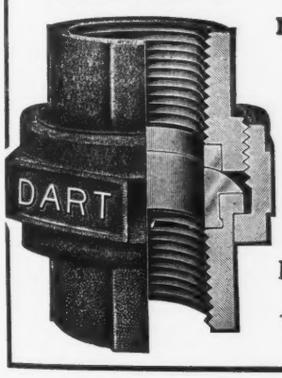
DART UNIONS



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Notice the clean, accurate threads and close fitting, rust proof bronze seats of the Dart cross section illustrated. Rusted out, leaky joints are practically impossible. It pays to specify Dart Unions, Tees, Flanges and Ells—they outlast the pipe. Send for samples and price list.

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Your Eventual Choice for All Turning

Sooner or later you're bound to come to Cincinnati Lathes—just as most up-to-date shop executives do. Reports of superlative turning records by Cincinnati equipment are becoming more common than ever before in their 25 years of precision and production work, as we tool up complete, for the jobs. Get the details of these unusually profitable and versatile cone and geared head lathes from 16" to 32", belt or motor drive. Send us your blue prints and we will be glad to figure with you.

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OAKLEY, CINCINNATI, OHIO, U.S.A.

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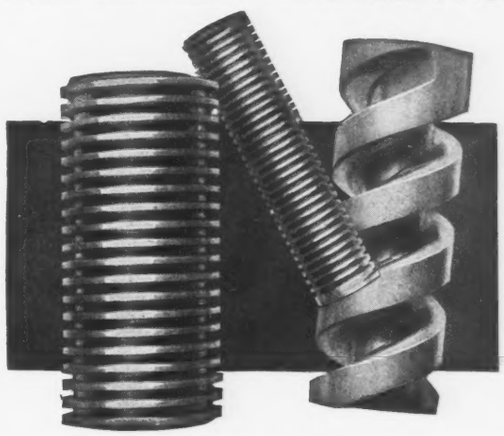

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Gardner Mch. Co., 414 E. Gardner St., Beloit, Wis.
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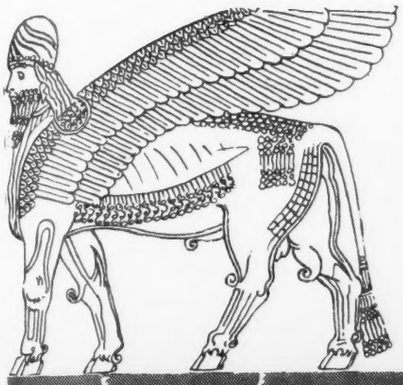
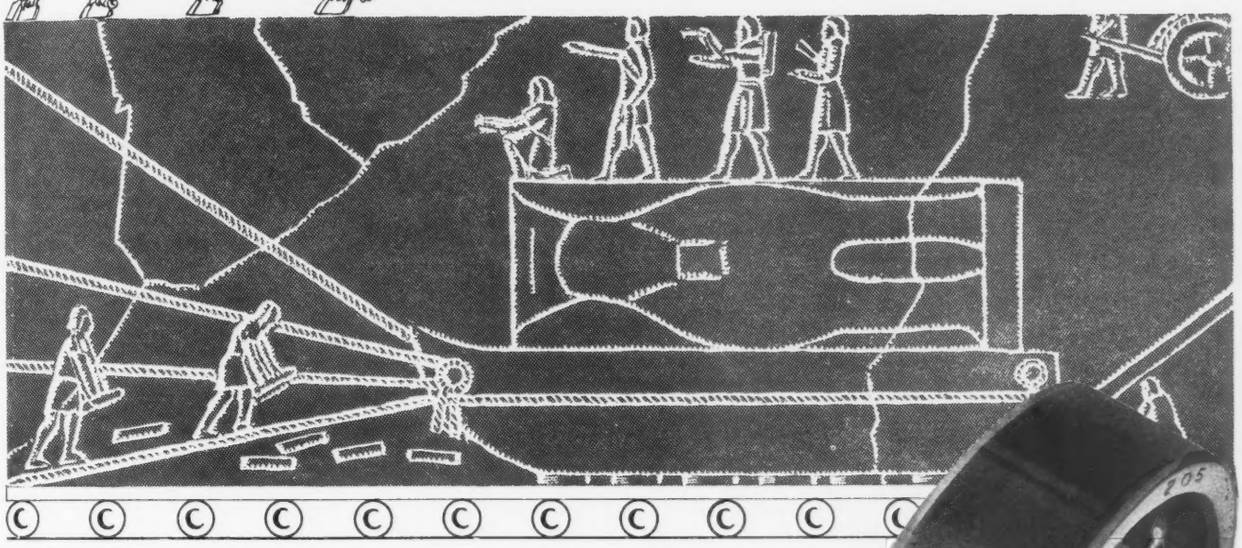
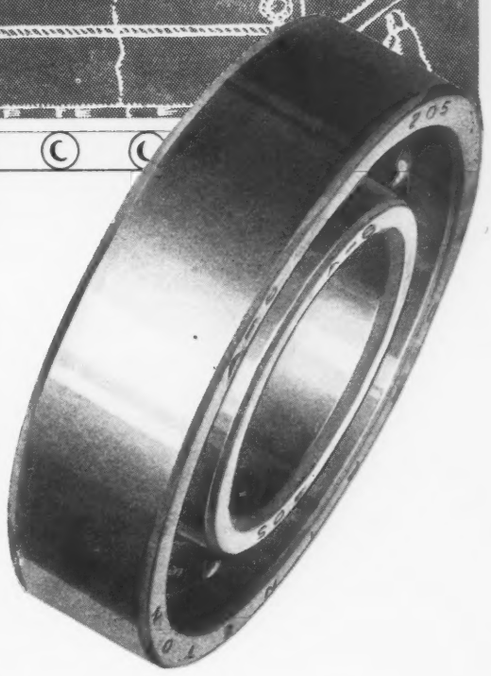


The World FIGHTS FRICTION



The building of the Pyramids presented problems of friction which this early civilization overcame only slowly and laboriously. However, these methods did represent progress. Both the Egyptians and the Assyrians faced with the task of transporting huge blocks of stone for the erection of temples and palaces dropped a series of wooden skids on the ground, upon which lubricants had been poured. The stone moved over these skids, armies of unfortunate slaves furnishing the motive power. So the war against friction, successfully waged today with ball bearings, proceeded on its historical course



POINTS where friction naturally develops are potential trouble makers. Be forehanded and install Torrington Ball Bearings at these vital spots.

Torrington Ball Bearings have established a clean cut reputation for reliability in overcoming friction... in operating at all times with the smooth ease characteristic of quality materials accurately manufactured. Torringtons are prestige-builders for far-seeing manufacturers.

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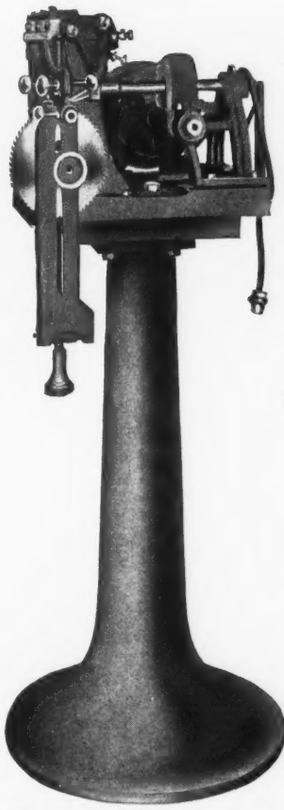

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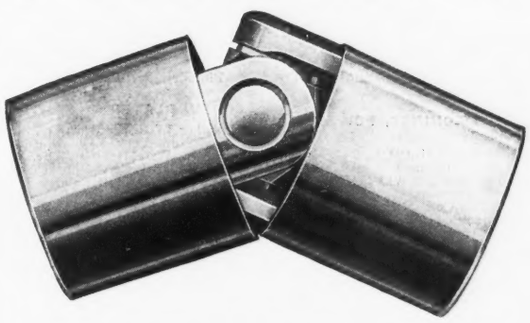

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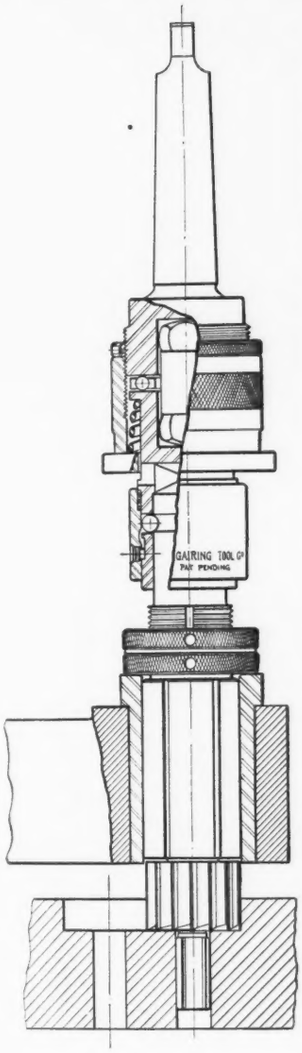
Guaranteed Fixture Accuracy Permitting the Fixture to Guide the Tool



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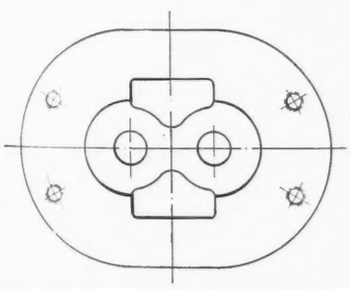

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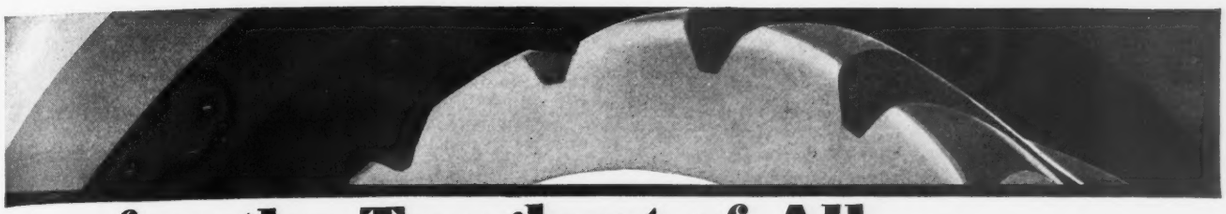

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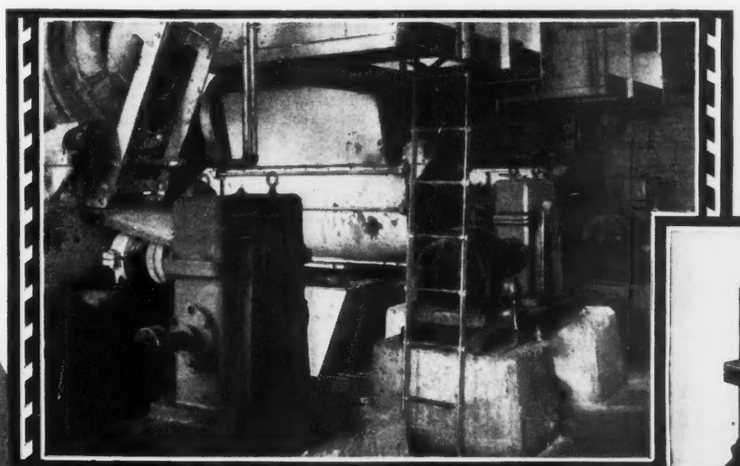

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Yale & Towne Mfg. Co., Stamford, Ct.

TRANSMISSION MACHINERY

See Hangers, Shafting, Pulleys, Clutches, Couplings, Belting, Chains, etc.

TRANSMISSION, VARIABLE SPEED

Oilgear Co., 660 Park St., Milwaukee.
Reeves Pulley Co., Columbus, Ind.

TROLLEYS AND TRAMWAYS

Chisholm-Moore Hoist Corp., 5038 Fremont Ave., Tonawanda, N. Y.
Hanna Engineering Wks., 1763 Elston Ave., Chicago.
Roeper Crane & Hoist Wks., Reading, Pa.
Shepard-Niles Crane & Hoist Corp., 380 Schuyler Ave., Montour Falls, N. Y.
Yale & Towne Mfg. Co., Stamford, Ct.

TRUCKS, INDUSTRIAL

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Angle Steel Stool Co., Plainwell, Mich.
Clark Tructractor Co., Battle Creek, Mich.
National Scale Corp., Chicopee Falls, Mass.
Yale & Towne Mfg. Co., Stamford, Ct.

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Watson-Stillman Co., 73 West St., N. Y.

TUBE FLANGING MACHINES

Grant Mfg. & Mch. Co., N.W. Station, Bridgeport, Conn.

TUBING, FLEXIBLE

Wheelock Mfg. Co., Wheelock, Vt.

TUBING, STEEL AND SEAMLESS STEEL

National Tube Co., Pittsburgh, Pa.
Timken Roller Bearing Co., Canton, O.

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Baird Mch. Co., Bridgeport, Conn.
Hartford Steel Ball Co., Hartford, Conn.
Royersford Fdry. & Mch. Co., Box M, Royersford, Pa.

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Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.
Whiton, D. E., Mch. Co., New London, Conn.

TURNTABLES

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TURRET LATHES, VERTICAL

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UNIONS

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UNIVERSAL JOINTS

Boston Gear Works Sales Co., Norfolk Downs, Quincy, Mass.
Gray & Prior Mch. Co., Hartford, Ct.

VALVE LEATHERS

Chicago Rawhide Mfg. Co., 1279 Elston Ave., Chicago.

VALVES, HYDRAULIC

Elmes Engineering Wks., Chas. F., 222 N. Morgan St., Chicago.
French Oil Mill Mchry. Co., Piqua, O.
Oilgear Co., 660 Park St., Milwaukee.
Watson-Stillman Co., 73 West St., N. Y.

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New Britain-Gridley Mch. Co., New Britain, Conn.
Reed Mfg. Co., Erie, Pa.

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Logansport Mch. Co., 529 Market St., Logansport, Ind.

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Brown Engineering Co., 133 N. Third St., Reading, Pa.
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Graham Mfg. Co., Providence, R. I.
LeBlond, R. K., Mch. Tool Co., Cincinnati.
Logansport Mch. Co., 529 Market St., Logansport, Ind.
Martin, J. E., Tool & Die Co., Springfield, O.
Purvis, Edw., & Sons, 110 York St., Brooklyn, N. Y.
Whitney Mfg. Co., Hartford, Conn.
Zernickow, O., Co., 21 Park Row, N. Y.

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Curtis & Curtis Co., 324 Garden St., Bridgeport, Conn.
Greenfield Tap & Die Corp., Greenfield, Mass.
Reed Mfg. Co., Erie, Pa.
Saunders', D., Sons, Inc., Yonkers, N. Y.
Williams, J. H., & Co., Buffalo, N. Y.

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Cincinnati Planer Co., Cincinnati.
Cincinnati Shaper Co., Cincinnati.
Hendey Machine Co., Torrington, Conn.
Western Mch. Tool Wks., Holland, Mich.

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Brown & Sharpe Mfg. Co., Providence.
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General Electric Co., Schenectady, N. Y.

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National Machinery Co., Tiffin, O.

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Fibroc Insulation Co., 1028 Lincoln Ave., Valparaiso, Ind.

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See Collars, Spacing, etc.

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Colt's Patent Fire Arms Mfg. Co., Hartford, Conn.

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Imperial Brass Mfg. Co., 531 S. Racine Ave., Chicago.

WELDING AND CUTTING, JOB

Taylor-Winfield Corp., Warren, O.
Thomson Electric Welding Co., Lynn, Mass.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Lincoln Electric Co., Cleveland.
Westinghouse Electric & Mfg. Co., East Pittsburgh, Pa.

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Federal Mch. & Welder Co., Warren, O.
Taylor-Winfield Corp., Warren, O.
Thomson Electric Welding Co., Lynn, Mass.

WELDING MACHINES, ELECTRIC SPOT

Acme Electric Welder Co., Los Angeles, Cal.
Federal Mch. & Welder Co., Warren, O.
Taylor-Winfield Corp., Warren, O.
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WHEELS, STEEL, R. R. AND INDUSTRIAL

Carnegie Steel Co., Pittsburgh, Pa.

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Ryerson, Joseph T., & Son, 2558 W. 16th St., Chicago.

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Shuster, F. B., Co., New Haven, Conn.

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Townsend, H. P., Mfg. Co., Hartford, Conn.

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Sidney Mch. Tool Co., Sidney, O.

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Ryerson, Joseph T., & Son, 2558 W. 16th St., Chicago.
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Greenfield Tap & Die Corp., Greenfield, Mass.
Reed Mfg. Co., Erie, Pa.
Williams, J. H., & Co., Buffalo, N. Y.

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Starrett, L. S., Co., Athol, Mass.
Williams, J. H., & Co., Buffalo, N. Y.

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Brubaker, W. L., & Bros. Co., 50 Church St., New York.
Card, S. W., Mfg. Co., Div. of Union Twist Drill Co., Mansfield, Mass.
Greenfield Tap & Die Corp., Greenfield, Mass.
Morse Twist Drill Mch. Co., New Bedford, Mass.
Pratt & Whitney Co., Hartford, Conn.
Starrett, L. S., Co., Athol, Mass.

ZINC

New Jersey Zinc Co., 160 Front St., New York.

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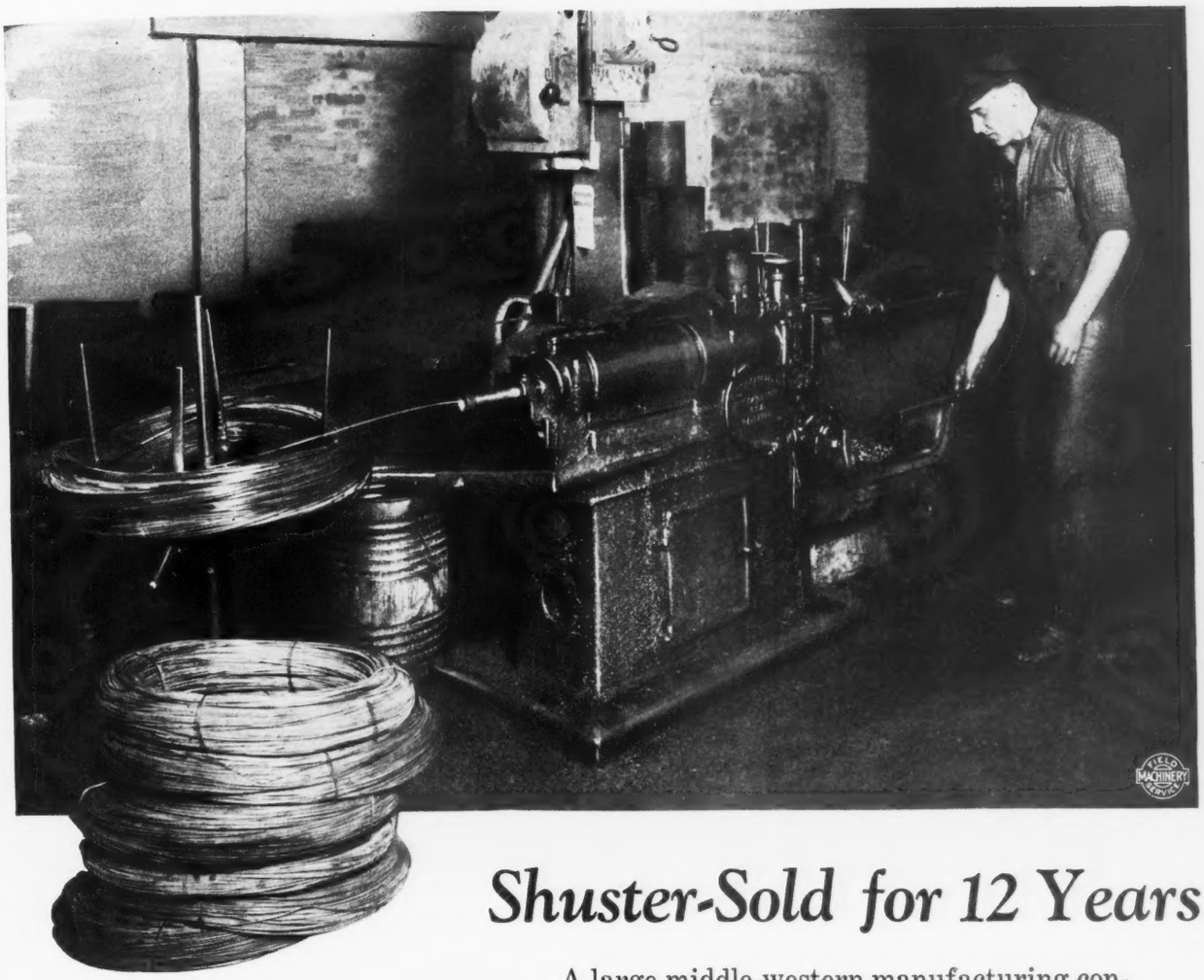

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Four of these machines, of varying sizes, are installed at the present time, and the one shown was cutting and straightening No. 10 Soft Annealed Core Wire when photographed. No production records covering these machines are available—none are necessary; their record speaks for itself. The owner's opinion of them is "Very Good!"

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Full information on request

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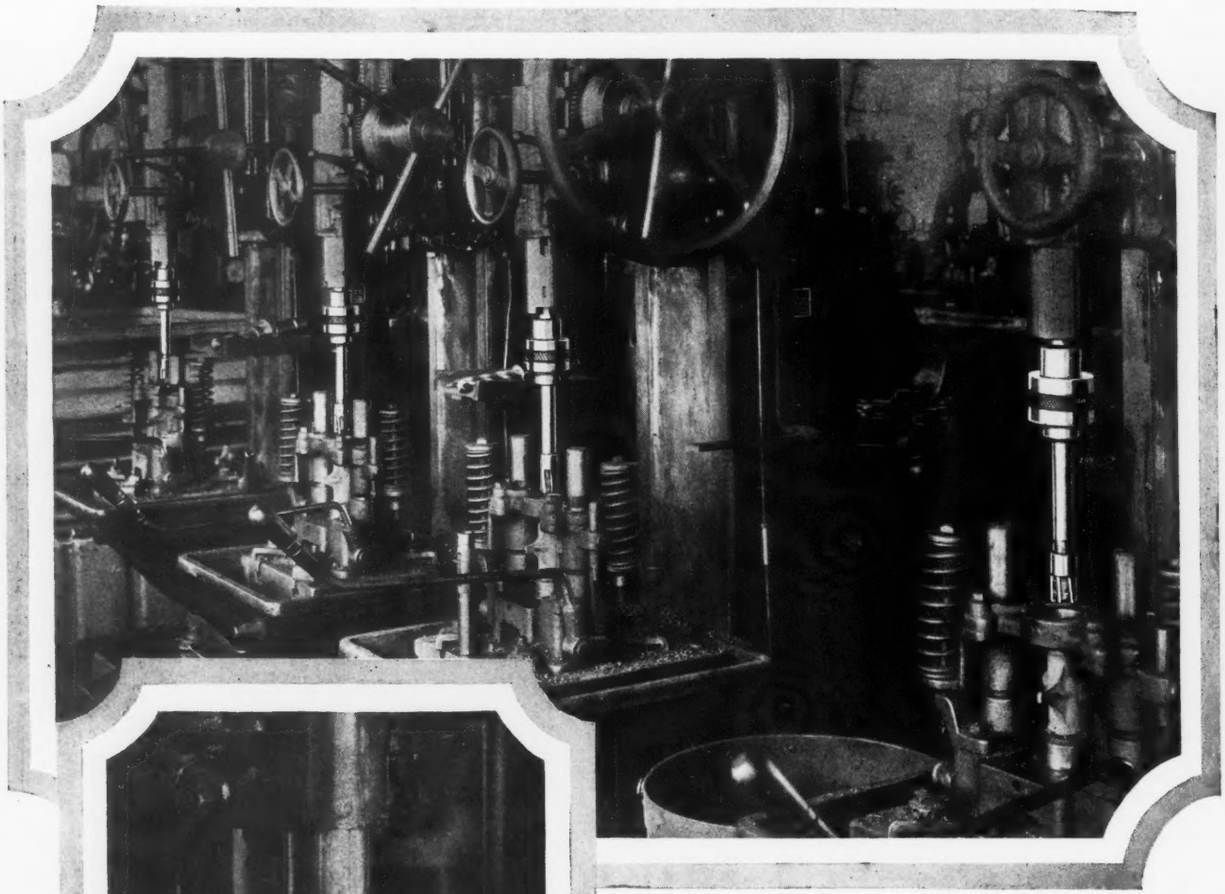
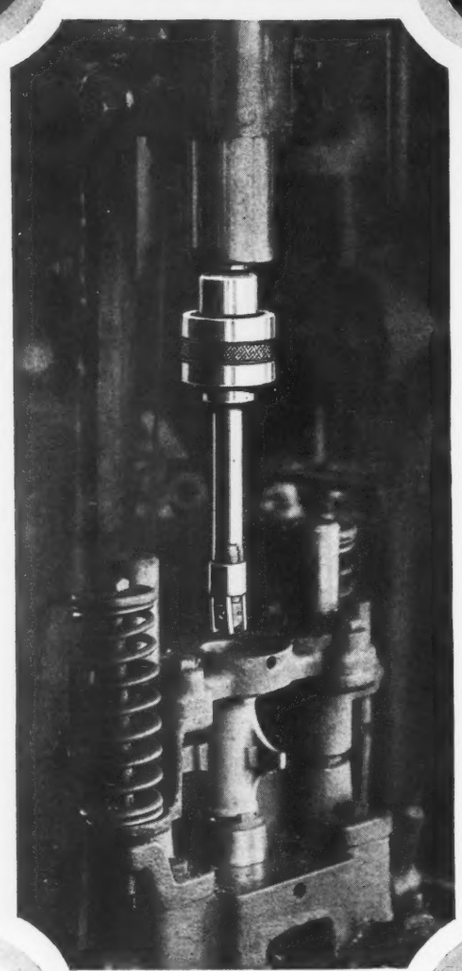
NEW HAVEN, CONN.
Straightener Specialists Since 1866

SHUSTER

Wire Straightening and Cutting-Off Machines





WIZARD Quick-Change Chucks and SUPER Adjustable Reamers Crowd Production Minutes

THIS battery of four drill presses is all set to fill every hour with sixty minutes of steady production. Each machine is equipped with a WIZARD Quick-Change Chuck and Collet Outfit. These outfits enable the operators to drill, bore and ream in quick succession without stopping the spindle.

Time is made productive without sacrifice of accuracy. WIZARD Chucks hold tools rigid and perfectly centered, an exclusive McCrosky feature that is particularly effective in reaming true holes.

McCrosky-SUPER Adjustable Machine Reamers finish the holes. The simple and positive McCrosky blade lock makes the assembled reamers as sturdy as the solid tools that prepare the holes for reaming.

Your modern drilling machines deserve the advantages WIZARD Chucks and SUPER Reamers can give them. Catalog No. 11 tells the whole story. Send for a copy.

Branches in Cleveland, Detroit, Chicago, Toronto

McCROSKY
Tool Corporation
Meadville, Pa., U. S. A.

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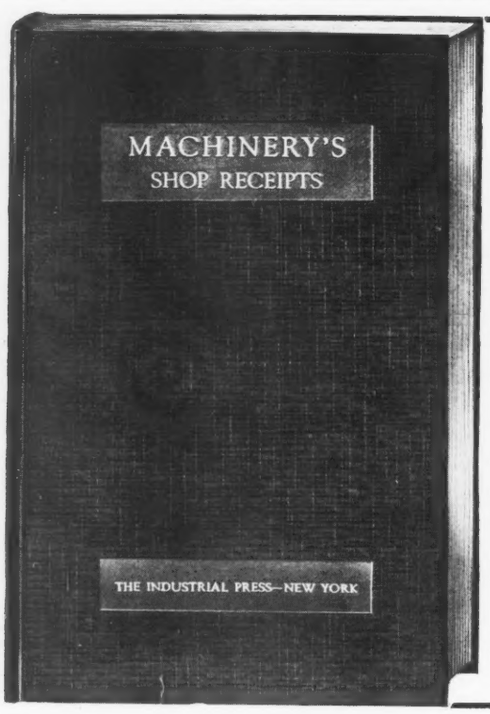

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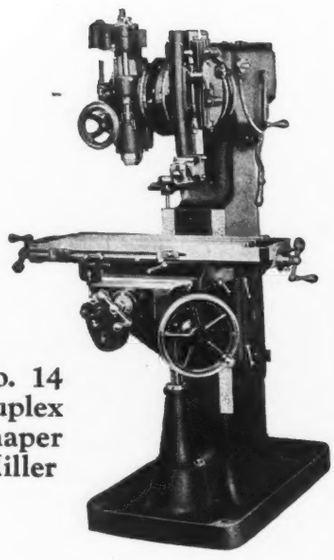

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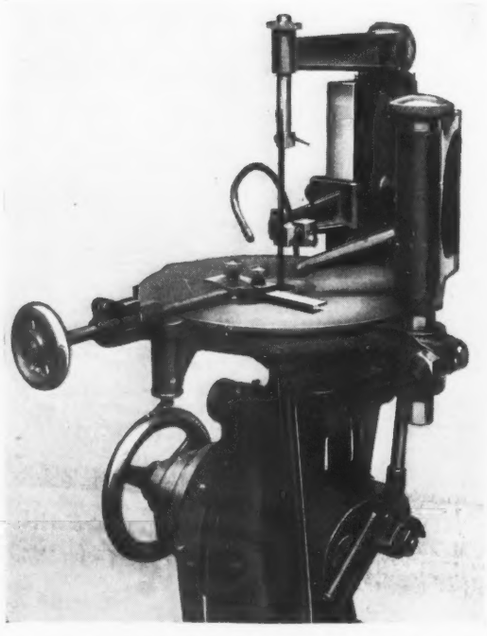

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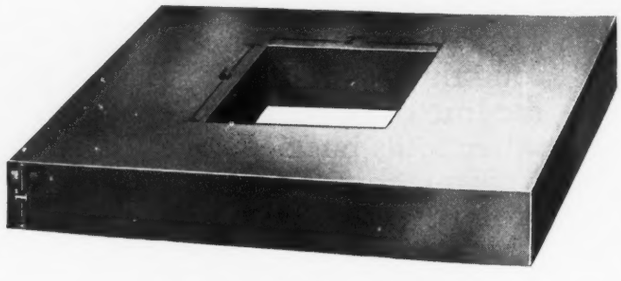

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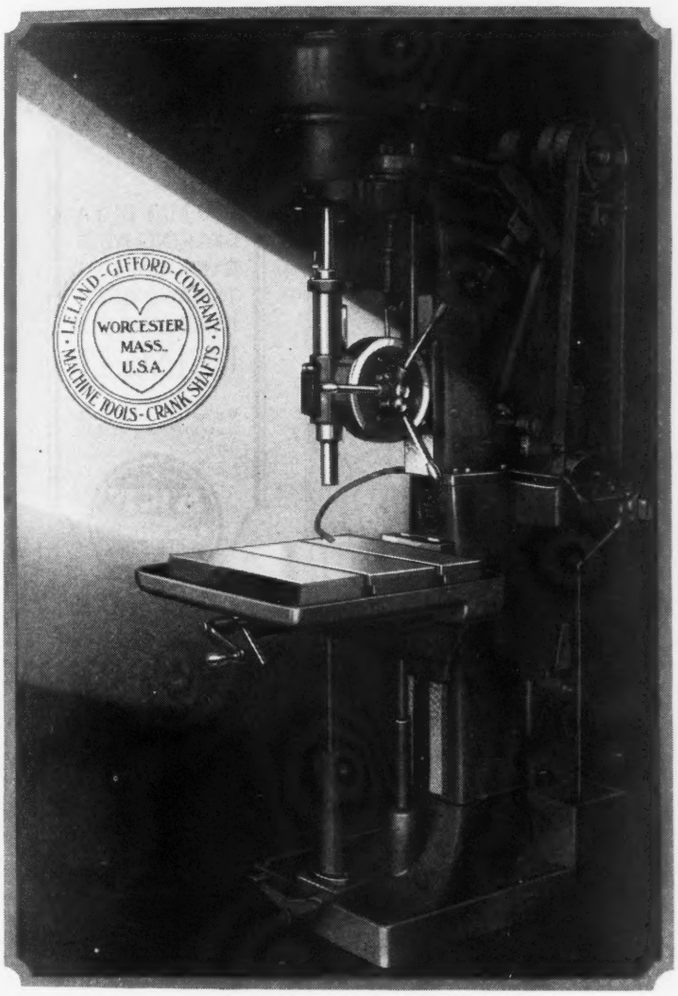

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